

=> d que 128

L1 1 SEA FILE=HCAPLUS ABB=ON PLU=ON US20060137600/PN
 L3 1 SEA FILE=REGISTRY ABB=ON PLU=ON 7429-90-5/RN
 L4 1 SEA FILE=REGISTRY ABB=ON PLU=ON 7727-37-9/RN
 L5 1 SEA FILE=REGISTRY ABB=ON PLU=ON 409-21-2/RN
 L6 1535625 SEA FILE=HCAPLUS ABB=ON PLU=ON L3 OR AL OR ALUMINIUM OR ALUMINIUM
 L7 419214 SEA FILE=HCAPLUS ABB=ON PLU=ON L4 OR N2 OR NITROGEN
 L8 138178 SEA FILE=HCAPLUS ABB=ON PLU=ON L5 OR CSI OR SIC OR SILICON CARBIDE#
 L10 38625 SEA FILE=HCAPLUS ABB=ON PLU=ON L8 AND (L6 OR L7)
 L12 112669 SEA FILE=HCAPLUS ABB=ON PLU=ON SEMICONDUCTORS+PFT,NT/CT
 L13 1113 SEA FILE=HCAPLUS ABB=ON PLU=ON L10 AND L12
 L14 8507 SEA FILE=HCAPLUS ABB=ON PLU=ON L10 AND (SUBSTRAT? OR WAFER? OR DISK# OR DISC#)
 L15 8958 SEA FILE=HCAPLUS ABB=ON PLU=ON L13 OR L14
 L16 3185 SEA FILE=HCAPLUS ABB=ON PLU=ON L15 AND DEV/RL
 L17 655 SEA FILE=HCAPLUS ABB=ON PLU=ON L16 AND DOP?
 L18 164 SEA FILE=HCAPLUS ABB=ON PLU=ON L17 AND (N-TYPE OR N(A) TYPE NTYPE OR PTYPE OR P(A) TYPE OR (N OR P) (2A) TYPE)
 L19 40 SEA FILE=HCAPLUS ABB=ON PLU=ON L18 AND CRYSTAL?
 L21 QUE ABB=ON PLU=ON MU OR MICRON OR MICROMETER OR MICRO (W)METER OR NANOMETER OR NANO(W)METER OR NM OR MM
 L22 14 SEA FILE=HCAPLUS ABB=ON PLU=ON L19 AND L21
 L23 0 SEA FILE=HCAPLUS ABB=ON PLU=ON L22 AND L1
 L24 40 SEA FILE=HCAPLUS ABB=ON PLU=ON L19 OR (L22 OR L23)
 L25 0 SEA FILE=HCAPLUS ABB=ON PLU=ON L24 AND INDEX (2A) DIRECT?
 L26 2 SEA FILE=HCAPLUS ABB=ON PLU=ON L24 AND (PARALLEL OR MILLER)
 L27 25 SEA FILE=HCAPLUS ABB=ON PLU=ON (L24 OR L25 OR L26) AND (1840-2003)/PRY,AY,PY
 L28 21 SEA FILE=HCAPLUS ABB=ON PLU=ON L27 AND ELECTRIC?/SC,SX

=> d que 147

L21 QUE ABB=ON PLU=ON MU OR MICRON OR MICROMETER OR MICRO (W)METER OR NANOMETER OR NANO(W)METER OR NM OR MM
 L30 67329 SEA FILE=WPIX ABB=ON PLU=ON SILICON CARBIDE# OR SIC
 L31 17751 SEA FILE=WPIX ABB=ON PLU=ON L30 AND (SUBSTRAT? OR WAFER? OR DISK# OR DISC# OR SEMICONDUCT? OR SEMI(A)CONDUCT?)
 L32 6081 SEA FILE=WPIX ABB=ON PLU=ON L31 AND (AL OR ALUMINIUM OR ALUMINIUM OR N2 OR NITROGEN)
 L33 QUE ABB=ON PLU=ON (N-TYPE OR N(A) TYPE NTYPE OR PTYPE OR P-TYPE OR P(A) TYPE OR (N OR P) (2A) TYPE)
 L34 483 SEA FILE=WPIX ABB=ON PLU=ON L32 AND L33
 L35 123 SEA FILE=WPIX ABB=ON PLU=ON L34 AND L21
 L36 6 SEA FILE=WPIX ABB=ON PLU=ON L35 AND (PARALLEL OR MILLER)
 L37 48 SEA FILE=WPIX ABB=ON PLU=ON L35 AND CRYSTAL?
 L38 31 SEA FILE=WPIX ABB=ON PLU=ON L37 AND DOP?
 L39 34 SEA FILE=WPIX ABB=ON PLU=ON L36 OR L38
 L40 28 SEA FILE=WPIX ABB=ON PLU=ON L39 AND (PY<2004 OR PRY<2004 OR AY<2004)
 L42 1 SEA FILE=WPIX ABB=ON PLU=ON US20060137600/PN
 L43 4 SEA FILE=WPIX ABB=ON PLU=ON L40 AND CARRIER CONCENTRATION?
 L44 1 SEA FILE=WPIX ABB=ON PLU=ON L40 AND CARRIER LIFETIME?

L45 1 SEA FILE=WPIX ABB=ON PLU=ON L40 AND C30B0015?/IPC
 L46 13 SEA FILE=WPIX ABB=ON PLU=ON L40 AND C30B?/IPC
 L47 16 SEA FILE=WPIX ABB=ON PLU=ON (L42 OR L43 OR L44 OR L45 OR
 L46)

=> d que 156

L21 QUE ABB=ON PLU=ON MU OR MICRON OR MICROMETER OR MICRO
 (W)METER OR NANOMETER OR NANO(W)METER OR NM OR MM
 L30 67329 SEA FILE=WPIX ABB=ON PLU=ON SILICON CARBIDE# OR SIC
 L31 17751 SEA FILE=WPIX ABB=ON PLU=ON L30 AND (SUBSTRAT? OR
 WAFER? OR DISK# OR DISC# OR SEMICONDUCT? OR SEMI(A)CONDUCT?
)
 L32 6081 SEA FILE=WPIX ABB=ON PLU=ON L31 AND (AL OR ALUMINUM OR
 ALUMINIUM OR N2 OR NITROGEN)
 L33 QUE ABB=ON PLU=ON (N-TYPE OR N(A)TYPE NTYPE OR PTYPE O
 R P-TYPE OR P(A)TYPE OR (N OR P)(2A)TYPE)
 L34 483 SEA FILE=WPIX ABB=ON PLU=ON L32 AND L33
 L48 82 SEA FILE=COMPENDEX ABB=ON PLU=ON L34 AND L21
 L49 24 SEA FILE=COMPENDEX ABB=ON PLU=ON L48 AND CRYSTAL?
 L50 1 SEA FILE=COMPENDEX ABB=ON PLU=ON L49 AND CARRIER(A) (CONCE
 NTRATION? OR LIFETIME?)
 L51 1 SEA FILE=COMPENDEX ABB=ON PLU=ON L49 AND (PARALLEL OR
 MILLER)
 L52 24 SEA FILE=COMPENDEX ABB=ON PLU=ON (L49 OR L50 OR L51)
 L53 14 SEA FILE=COMPENDEX ABB=ON PLU=ON L52 AND (PY<2004 OR
 PRY<2004 OR AY<2004)
 L56 9 SEA FILE=COMPENDEX ABB=ON PLU=ON L53 AND DOP?

=> d que 155

L21 QUE ABB=ON PLU=ON MU OR MICRON OR MICROMETER OR MICRO
 (W)METER OR NANOMETER OR NANO(W)METER OR NM OR MM
 L30 67329 SEA FILE=WPIX ABB=ON PLU=ON SILICON CARBIDE# OR SIC
 L31 17751 SEA FILE=WPIX ABB=ON PLU=ON L30 AND (SUBSTRAT? OR
 WAFER? OR DISK# OR DISC# OR SEMICONDUCT? OR SEMI(A)CONDUCT?
)
 L32 6081 SEA FILE=WPIX ABB=ON PLU=ON L31 AND (AL OR ALUMINUM OR
 ALUMINIUM OR N2 OR NITROGEN)
 L33 QUE ABB=ON PLU=ON (N-TYPE OR N(A)TYPE NTYPE OR PTYPE O
 R P-TYPE OR P(A)TYPE OR (N OR P)(2A)TYPE)
 L34 483 SEA FILE=WPIX ABB=ON PLU=ON L32 AND L33
 L48 82 SEA FILE=COMPENDEX ABB=ON PLU=ON L34 AND L21
 L49 24 SEA FILE=COMPENDEX ABB=ON PLU=ON L48 AND CRYSTAL?
 L50 1 SEA FILE=COMPENDEX ABB=ON PLU=ON L49 AND CARRIER(A) (CONCE
 NTRATION? OR LIFETIME?)
 L51 1 SEA FILE=COMPENDEX ABB=ON PLU=ON L49 AND (PARALLEL OR
 MILLER)
 L52 24 SEA FILE=COMPENDEX ABB=ON PLU=ON (L49 OR L50 OR L51)
 L54 15 SEA FILE=JAPIO ABB=ON PLU=ON L52 AND (PY<2004 OR
 PRY<2004 OR AY<2004)
 L55 4 SEA FILE=JAPIO ABB=ON PLU=ON L54 AND DOP?

=> dup rem 128 147 156 155

FILE 'HCAPLUS' ENTERED AT 16:04:18 ON 01 NOV 2007

USE IS SUBJECT TO THE TERMS OF YOUR STN CUSTOMER AGREEMENT.
 PLEASE SEE "HELP USAGETERMS" FOR DETAILS.

COPYRIGHT (C) 2007 AMERICAN CHEMICAL SOCIETY (ACS)

FILE 'WPIX' ENTERED AT 16:04:18 ON 01 NOV 2007
 COPYRIGHT (C) 2007 THE THOMSON CORPORATION

FILE 'COMPENDEX' ENTERED AT 16:04:18 ON 01 NOV 2007
 Compendex Compilation and Indexing (C) 2007
 Elsevier Engineering Information Inc (EEI). All rights reserved.
 Compendex (R) is a registered Trademark
 of Elsevier Engineering Information Inc.

FILE 'JAPIO' ENTERED AT 16:04:18 ON 01 NOV 2007
 COPYRIGHT (C) 2007 Japanese Patent Office (JPO)- JAPIO
 PROCESSING COMPLETED FOR L28
 PROCESSING COMPLETED FOR L47
 PROCESSING COMPLETED FOR L56
 PROCESSING COMPLETED FOR L55
 L57 49 DUP REM L28 L47 L56 L55 (1 DUPLICATE REMOVED)
 ANSWERS '1-21' FROM FILE HCAPLUS
 ANSWERS '22-36' FROM FILE WPIX
 ANSWERS '37-45' FROM FILE COMPENDEX
 ANSWERS '46-49' FROM FILE JAPIO

=> d 1-21 ibib ed abs hitstr hitind

L57 ANSWER 1 OF 49 HCAPLUS COPYRIGHT 2007 ACS on STN DUPLICATE 1
 ACCESSION NUMBER: 2004:204026 HCAPLUS Full-text
 DOCUMENT NUMBER: 140:244889
 TITLE: Lightly doped silicon
 carbide wafer and use thereof in
 high power devices
 INVENTOR(S): Ellison, Alexandre; Magnusson, Bjoern; Vehanen,
 Asko; Stephani, Dietrich; Mitlehner, Heinz;
 Friedrichs, Peter
 PATENT ASSIGNEE(S): Okmetic Oyj, Finland; Siced Electronics
 Development G.m.b.H. & Co. K.-G.
 SOURCE: PCT Int. Appl., 27 pp.
 CODEN: PIXXD2
 DOCUMENT TYPE: Patent
 LANGUAGE: English
 FAMILY ACC. NUM. COUNT: 1
 PATENT INFORMATION:

PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
-----	----	-----	-----	-----
WO 2004020706	A1	20040311	WO 2003-SE1309	20030822
			<--	
W: JP, US				
RW: AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU,				
IE, IT, LU, MC, NL, PT, RO, SE, SI, SK, TR				
SE 2002002585	A	20040301	SE 2002-2585	20020830
			<--	
SE 525574	C2	20050315		
EP 1540050	A1	20050615	EP 2003-791515	20030822
			<--	
R: AT, BE, CH, DE, DK, ES, FR, GB, GR, IT, LI, LU, NL, SE, MC,				
PT, IE, SI, FI, RO, CY, TR, BG, CZ, EE, HU, SK				
JP 2005537657	T	20051208	JP 2004-532493	20030822
			<--	
US 2006137600	A1	20060629	US 2005-526059	20051013
			<--	

PRIORITY APPLN. INFO.: SE 2002-2585 A 20020830
 <--
 WO 2003-SE1309 W 20030822
 <--

ED Entered STN: 14 Mar 2004

AB The 1st object of this invention is a method to fabricate SiC wafers from lightly doped n- or p -type crystals having a quality such that these wafers can be used as the base layer of high voltage power devices. This method enables a lower cost solution than the conventional CVD growth of a thick lightly doped layer on a low resistivity SiC substrate. The 2nd object of the invention is a novel semiconductor structure able to block very high voltages. Instead of using a highly doped substrate, which in the case of a vertical power device represents an unnecessary addnl. resistance, the device of the invention uses a lightly doped wafer as n-drift zone.

IT 7429-90-5, Aluminum, uses 7727-37-9,
 Nitrogen, uses
 (dopants; fabrication of lightly doped
 silicon carbide wafer and its use in
 high power devices)

RN 7429-90-5 HCAPLUS

CN Aluminum (CA INDEX NAME)

Al

RN 7727-37-9 HCAPLUS

CN Nitrogen (CA INDEX NAME)

N
 N

IT 409-21-2, Silicon carbide, uses
 (fabrication of lightly doped silicon
 carbide wafer and its use in high power devices)

RN 409-21-2 HCAPLUS

CN Silicon carbide (SiC) (CA INDEX NAME)

*** STRUCTURE DIAGRAM IS NOT AVAILABLE ***

IC ICM C30B029-36

ICS H01L029-12

CC 76-3 (Electric Phenomena)

Section cross-reference(s): 75

ST doped silicon carbide wafer

fabrication IGBT

IT Silanes

(alkyl, precursors; fabrication of lightly doped
 silicon carbide wafer and its use in
 high power devices)

IT Vapor deposition process

(chemical, high-temperature; fabrication of lightly doped
 silicon carbide wafer and its use in
 high power devices)

IT Silanes

(chloro, precursors; fabrication of lightly doped silicon carbide wafer and its use in high power devices)

IT Bipolar transistors
(fabrication of lightly doped silicon carbide wafer and its use in high power devices)

IT 7429-90-5, Aluminum, uses 7727-37-9, Nitrogen, uses
(dopants; fabrication of lightly doped silicon carbide wafer and its use in high power devices)

IT 409-21-2, Silicon carbide, uses
(fabrication of lightly doped silicon carbide wafer and its use in high power devices)

IT 74-82-8, Methane, processes 74-85-1, Ethylene, processes 74-98-6, Propane, processes 7803-62-5, Silane, processes
(precursors; fabrication of lightly doped silicon carbide wafer and its use in high power devices)

REFERENCE COUNT: 4 THERE ARE 4 CITED REFERENCES AVAILABLE FOR THIS RECORD. ALL CITATIONS AVAILABLE IN THE RE FORMAT

L57 ANSWER 2 OF 49 HCAPLUS COPYRIGHT 2007 ACS on STN
 ACCESSION NUMBER: 2004:1020196 HCAPLUS Full-text
 DOCUMENT NUMBER: 141:417714
 TITLE: LED fabrication via ion implant isolation
 INVENTOR(S): Wu, Yifeng; Negley, Gerald H.; Slater, David B., Jr.; Tsvetkov, Valeri F.; Suvorov, Alexander
 PATENT ASSIGNEE(S): Cree, Inc., USA
 SOURCE: PCT Int. Appl., 34 pp.
 CODEN: PIXXD2
 DOCUMENT TYPE: Patent
 LANGUAGE: English
 FAMILY ACC. NUM. COUNT: 1
 PATENT INFORMATION:

PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
WO 2004102686	A1	20041125	WO 2004-US14023	20040506
<--				
W: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NA, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW RW: BW, GH, GM, KE, LS, MM, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW, AM, AZ, BY, KG, KZ, MD, RU, TJ, TM, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PL, PT, RO, SE, SI, SK, TR, BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG				
US 2005029533	A1	20050210	US 2004-840463	20040505
<--				
US 2006108595	A9	20060525		
EP 1623467	A1	20060208	EP 2004-751419	20040506
<--				
R: AT, BE, CH, DE, DK, ES, FR, GB, GR, IT, LI, LU, NL, SE, MC, PT, IE, SI, FI, RO, CY, TR, BG, CZ, EE, HU, PL, SK				
CN 1802755	A	20060712	CN 2004-80012561	20040506

JP 2006528435	T	20061214	JP 2006-532792	20040506
			<--	
US 2005285126	AI	20051229	US 2005-154619	20050616
PRIORITY APPLN. INFO.:			US 2003-320182P	P 20030509
			<--	
			US 2004-840463	AI 20040505
			WO 2004-US14023	W 20040506

ED Entered STN: 26 Nov 2004

AB A semiconductor light emitting diode is described comprising a semiconductor substrate, an epitaxial layer of n-type Group III nitride on the substrate, a p-type epitaxial layer of Group III nitride on the n-type epitaxial layer and forming a p-n junction with the n-type layer, and a resistive gallium nitride region on the n-type epitaxial layer and adjacent the p-type epitaxial layer for elec. isolating portions of the p-n junction. A method of isolating a p-n junction in a semiconductor diode is also described entailing implanting ions into an epitaxial layer of the diode adjacent the p-n junction and having a first conductivity type in a pattern that defines an implanted perimeter sufficiently doped with the implanted ions to be highly resistive to thereby isolate the junction within the implanted perimeter. A method of fabricating the light emitting diode is also described.

IT 7727-37-9, Nitrogen, uses
(implanted ion; LED fabrication via ion implant isolation)
RN 7727-37-9 HCAPLUS
CN Nitrogen (CA INDEX NAME)

N
N

IT 7429-90-5, Aluminum, uses
(ohmic contact; LED fabrication via ion implant isolation)
RN 7429-90-5 HCAPLUS
CN Aluminum (CA INDEX NAME)

AI

IT 409-21-2, Silicon carbide (SiC),
uses
(substrate, n-type; LED fabrication
via ion implant isolation)
RN 409-21-2 HCAPLUS
CN Silicon carbide (SiC) (CA INDEX NAME)

*** STRUCTURE DIAGRAM IS NOT AVAILABLE ***

IC ICM H01L033-00

ICS H01L021-265

CC 73-11 (Optical, Electron, and Mass Spectroscopy and Other Related
Properties)

Section cross-reference(s): 76

IT Spinel-type crystals

(substrate; LED fabrication via ion implant isolation)
 IT 25617-97-4, Gallium nitride (GaN) 106097-44-3, Aluminum gallium nitride ((Al,Ga)N)
 (epitaxial region, p-type, substrate;
 LED fabrication via ion implant isolation)
 IT 7439-95-4, Magnesium, uses
 (epitaxial region, p-type, substrate;
 LED fabrication via ion implant isolation)
 IT 7440-59-7, Helium, uses 7723-14-0, Phosphorus, uses
 7727-37-9, Nitrogen, uses 12385-13-6, Hydrogen atom, uses
 17778-88-0, Atomic nitrogen, uses
 (implanted ion; LED fabrication via ion implant isolation)
 IT 7429-90-5, Aluminum, uses 7440-02-0, Nickel, uses
 7440-06-4, Platinum, uses 7440-22-4, Silver, uses 7440-32-6,
 Titanium, uses 7440-57-5, Gold, uses
 (ohmic contact; LED fabrication via ion implant isolation)
 IT 409-21-2, Silicon carbide (SiC),
 uses
 (substrate, n-type; LED fabrication
 via ion implant isolation)
 IT 1309-48-4, Magnesium oxide (MgO), uses 1314-13-2, Zinc oxide (ZnO),
 uses 1344-28-1, Alumina, uses 7440-21-3, Silicon, uses
 24304-00-5, Aluminum nitride (AlN)
 (substrate; LED fabrication via ion implant isolation)
 REFERENCE COUNT: 7 THERE ARE 7 CITED REFERENCES AVAILABLE FOR
 THIS RECORD. ALL CITATIONS AVAILABLE IN THE
 RE FORMAT

L57 ANSWER 3 OF 49 HCAPLUS COPYRIGHT 2007 ACS on STN
 ACCESSION NUMBER: 2004:433600 HCAPLUS [Full-text](#)
 DOCUMENT NUMBER: 140:414663
 TITLE: Oxide semiconductor light-emitting elements with
 excellent emission efficiency and low driving
 voltage
 INVENTOR(S): Saito, Hajime
 PATENT ASSIGNEE(S): Sharp Corp., Japan
 SOURCE: Jpn. Kokai Tokkyo Koho, 12 pp.
 CODEN: JKXXAF
 DOCUMENT TYPE: Patent
 LANGUAGE: Japanese
 FAMILY ACC. NUM. COUNT: 1
 PATENT INFORMATION:

PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
-----	----	-----	-----	-----
JP 2004153211	A	20040527	JP 2002-319666	20021101
			<--	
PRIORITY APPLN. INFO.:			JP 2002-319666	20021101
			<--	

ED Entered STN: 28 May 2004

AB The elements, useful for LED and semiconductor lasers, have n -type clad layers, active layers, p-type clad layers, and p-type contact layers in this order on substrates, wherein In-doped n -type ZnO semiconductor layers are formed between the substrates and n-type clad layers, thus preventing crystal defects in epitaxial layers. Light-transmitting p-type ohmic electrodes may be formed over the contact layers.

IT 409-21-2, Silicon carbide, uses
 (conductive substrate; LED and semiconductor lasers
 having In-doped ZnO layers with good emission efficiency
 and low driving voltage)

RN 409-21-2 HCAPLUS
 CN Silicon carbide (SiC) (CA INDEX NAME)

*** STRUCTURE DIAGRAM IS NOT AVAILABLE ***

IT 7727-37-9, Nitrogen, uses
 (dopant, contact layer; LED and semiconductor lasers
 having In-doped ZnO layers with good emission efficiency
 and low driving voltage)

RN 7727-37-9 HCAPLUS
 CN Nitrogen (CA INDEX NAME)

N
 N

IC ICM H01L033-00
 ICS H01L021-363; H01S005-30
 CC 73-10 (Optical, Electron, and Mass Spectroscopy and Other Related
 Properties)
 Section cross-reference(s): 76
 ST oxide semiconductor semiconductor laser extn efficiency; indium
 dopant zinc oxide epitaxy crystallinity; LED
 sapphire substrate crystal defect prevention
 IT Electroluminescent devices
 Semiconductor lasers
 (LED and semiconductor lasers having In-doped ZnO layers
 with good emission efficiency and low driving voltage)
 IT 116790-45-5, Magnesium zinc oxide (Mg0.05Zn0.95O)
 (barrier layer; LED and semiconductor lasers having In-
 doped ZnO layers with good emission efficiency and low
 driving voltage)
 IT 1314-13-2, Zinc oxide (ZnO), uses
 (buffer, active, or contact layer or substrate; LED and
 semiconductor lasers having In-doped ZnO layers with good
 emission efficiency and low driving voltage)
 IT 116790-33-1, Magnesium zinc oxide (Mg0.1Zn0.9O) 116790-44-4,
 Magnesium zinc oxide (Mg0.2Zn0.8O)
 (clad layer; LED and semiconductor lasers having In-doped
 ZnO layers with good emission efficiency and low driving voltage)
 IT 409-21-2, Silicon carbide, uses
 25617-97-4, Gallium nitride
 (conductive substrate; LED and semiconductor lasers
 having In-doped ZnO layers with good emission efficiency
 and low driving voltage)
 IT 1317-82-4, Sapphire
 (dielec. substrate; LED and semiconductor lasers having
 In-doped ZnO buffer layers with good emission efficiency
 and low driving voltage)
 IT 7440-74-6, Indium, uses
 (dopant, buffer, clad, or well layer; LED and
 semiconductor lasers having In-doped ZnO layers with good
 emission efficiency and low driving voltage)
 IT 7440-55-3, Gallium, uses
 (dopant, clad layer; LED and semiconductor lasers having
 In-doped ZnO layers with good emission efficiency and low
 driving voltage)
 IT 7727-37-9, Nitrogen, uses

(dopant, contact layer; LED and semiconductor lasers having In-doped ZnO layers with good emission efficiency and low driving voltage)

IT 187748-97-6, Cadmium zinc oxide (Cd_{0.2}Zn_{0.8}O)
(well layer; LED and semiconductor lasers having In-doped ZnO layers with good emission efficiency and low driving voltage)

L57 ANSWER 4 OF 49 HCAPLUS COPYRIGHT 2007 ACS on STN

ACCESSION NUMBER: 2003:343862 HCAPLUS Full-text

DOCUMENT NUMBER: 139:139790

TITLE: Characterization of epitaxial SiC
Schottky barriers as particle detectors

AUTHOR(S): Bruzzi, M.; Lagomarsino, S.; Nava, F.; Sciortino, S.

CORPORATE SOURCE: Dipartimento di Energetica, INFN, Florence, 50139, Italy

SOURCE: Diamond and Related Materials (2003),
12(3-7), 1205-1208

CODEN: DRMTIE3; ISSN: 0925-9635

PUBLISHER: Elsevier Science B.V.

DOCUMENT TYPE: Journal

LANGUAGE: English

ED Entered STN: 06 May 2003

AB Epitaxial SiC devices were tested as radiation detectors for min. ionizing particles. The devices used are based on a com. 4H- SiC epitaxial n-type layer deposited onto a 4H-SiC n+ type substrate wafer doped with N. Single-pad Schottky contacts were produced by deposition of a 1000-Å Au film on the epitaxial layer using a lift-off technol. and ohmic contacts were deposited on the rear substrate side. The capacitance-voltage characteristics determine the net effective doping in the space charge layer and the maximum active thickness of the devices. The measurements showed possible nonuniformity in the net doping of the epitaxial layer. The charge collection efficiency (CCE) was tested by a 0.1 mCi 90Sr β -source. A 100% CCE is measured at the maximum active thickness, which is achieved .gtorsim.400 V. The charge signal of the SiC devices is stable and reproducible, with no evidence of priming or polarization effects, due to the high crystalline quality of the epitaxial layer.

IT 409-21-2, Silicon carbide (SiC),
uses

(nitrogen doped; epitaxial silicon
carbide devices tested as radiation detectors for min.
ionizing particles)

RN 409-21-2 HCAPLUS

CN Silicon carbide (SiC) (CA INDEX NAME)

*** STRUCTURE DIAGRAM IS NOT AVAILABLE ***

IT 7727-37-9, Nitrogen, uses
(silicon carbide dopant; epitaxial
silicon carbide devices tested as radiation
detectors for min. ionizing particles)

RN 7727-37-9 HCAPLUS

CN Nitrogen (CA INDEX NAME)

CC 71-7 (Nuclear Technology)
 Section cross-reference(s): 76

ST charged particle detector silicon carbide Schottky diode

IT Electric current
 (dark; epitaxial silicon carbide devices tested as radiation detectors for min. ionizing particles)

IT Beta particle detectors
 Charged particle detectors
 Electric capacitance-potential relationship
 Epitaxial films
 Leakage current
 Schottky diodes
 (epitaxial silicon carbide devices tested as radiation detectors for min. ionizing particles)

IT Dopants
 (nitrogen; epitaxial silicon carbide devices tested as radiation detectors for min. ionizing particles)

IT 7440-57-5, Gold, uses
 (epitaxial silicon carbide devices tested as radiation detectors for min. ionizing particles)

IT 409-21-2, Silicon carbide (SiC), uses
 (nitrogen doped; epitaxial silicon carbide devices tested as radiation detectors for min. ionizing particles)

IT 7727-37-9, Nitrogen, uses
 (silicon carbide dopant; epitaxial silicon carbide devices tested as radiation detectors for min. ionizing particles)

REFERENCE COUNT: 10 THERE ARE 10 CITED REFERENCES AVAILABLE FOR THIS RECORD. ALL CITATIONS AVAILABLE IN THE RE FORMAT

L57 ANSWER 5 OF 49 HCAPLUS COPYRIGHT 2007 ACS on STN

ACCESSION NUMBER: 2003:846393 HCAPLUS Full-text

DOCUMENT NUMBER: 140:136056

TITLE: Laser-metalized silicon carbide Schottky diodes for millimeter wave detection and frequency mixing

AUTHOR(S): Salama, I. A.; Middleton, C. F.; Quick, N. R.; Boreman, G. D.; Kar, A.

CORPORATE SOURCE: School of Optics, Center for Research and Education in Optics and Lasers (CREOL), University of Central Florida, Orlando, FL, 32816, USA

SOURCE: Proceedings - Electrochemical Society (2003), 2003-11(State-of-the-Art Program on Compound Semiconductors XXXIX and Nitride and Wide Bandgap Semiconductors for Sensors, Photonics, and Electronics IV), 270-281
 CODEN: PESODO; ISSN: 0161-6374

PUBLISHER: Electrochemical Society

DOCUMENT TYPE: Journal

LANGUAGE: English

ED Entered STN: 29 Oct 2003

AB Laser direct write is a unique process to alter the elec. properties of many semiconductor materials. It is particularly useful for processing wide bandgap materials because it allows metalization without adding any metal to the substrate to fabricate both ohmic and Schottky contacts. The metalization occurs inside the substrate which offers the prospect of via-less

interconnects. It also enables both n-type and p-type doping in such materials. Such techniques can be used to produce electronic devices monolithically. Schottky diodes were fabricated using the laser direct write technique. Such diodes were used to make antenna-coupled diodes for millimeter wave detection and imaging. The diodes also operate as frequency mixers at high frequencies (.apprx.92 GHz), which can be used as a tunable device for communication applications. The mixers can also be used to identify chemical species and study intermediate species in chemical reactions.

IT 409-21-2, Silicon carbide (SiC),
properties
(laser-metalized and doped silicon
carbide Schottky diodes for millimeter wave detection and
frequency mixing)
RN 409-21-2 HCAPLUS
CN Silicon carbide (SiC) (CA INDEX NAME)

*** STRUCTURE DIAGRAM IS NOT AVAILABLE ***

IT 7727-37-9, Nitrogen, uses
(laser-metalized and doped silicon
carbide Schottky diodes for millimeter wave detection and
frequency mixing)
RN 7727-37-9 HCAPLUS
CN Nitrogen (CA INDEX NAME)

N
N

IT 7429-90-5P, Aluminum, uses
(silicon carbide dopant;
laser-metalized and doped silicon
carbide Schottky diodes for millimeter wave detection and
frequency mixing)
RN 7429-90-5 HCAPLUS
CN Aluminum (CA INDEX NAME)

Al

CC 73-11 (Optical, Electron, and Mass Spectroscopy and Other Related
Properties)
Section cross-reference(s): 76
ST microwave detector mixer Schottky diode silicon
carbide laser metalization
IT Crystal vacancies
(dopants; laser-metalized and doped
silicon carbide Schottky diodes for millimeter
wave detection and frequency mixing)
IT Annealing
Doping
Electric current-potential relationship
Electric resistance
Laser radiation

Microwave detectors
 Schottky contacts
 Schottky diodes
 (laser-metalized and doped silicon
 carbide Schottky diodes for millimeter wave detection and
 frequency mixing)

IT Communication
 Imaging
 (microwave; laser-metalized and doped silicon
 carbide Schottky diodes for millimeter wave detection and
 frequency mixing)

IT Microwave devices
 (mixers; laser-metalized and doped silicon
 carbide Schottky diodes for millimeter wave detection and
 frequency mixing)

IT Contact resistance
 (of laser-metalized silicon carbide Schottky
 diodes for millimeter wave detection and frequency mixing)

IT 75-24-1, Trimethylaluminum
 (aluminum dopant precursor; laser-metalized and
 doped silicon carbide Schottky diodes
 for millimeter wave detection and frequency mixing)

IT 7439-95-4P, Magnesium, uses
 (gallium nitride dopant; laser doping of
 gallium nitride)

IT 25617-97-4, Gallium nitride
 (laser doping of gallium nitride)

IT 409-21-2, Silicon carbide (SiC),
 properties
 (laser-metalized and doped silicon
 carbide Schottky diodes for millimeter wave detection and
 frequency mixing)

IT 7440-02-0, Nickel, uses 7440-32-6, Titanium, uses
 (laser-metalized and doped silicon
 carbide Schottky diodes for millimeter wave detection and
 frequency mixing)

IT 7440-37-1, Argon, uses 7440-59-7, Helium, uses 7727-37-9,
 Nitrogen, uses 7782-44-7, Oxygen, uses
 (laser-metalized and doped silicon
 carbide Schottky diodes for millimeter wave detection and
 frequency mixing)

IT 21361-35-3, Magnesium bis(2,2,6,6-tetramethylheptane-3,5-dionate)
 (magnesium precursor; laser doping of gallium nitride)

IT 7429-90-5P, Aluminum, uses
 (silicon carbide dopant;
 laser-metalized and doped silicon
 carbide Schottky diodes for millimeter wave detection and
 frequency mixing)

IT 7440-21-3, Silicon, processes
 (silicon carbide vacancy formation;
 laser-metalized and doped silicon
 carbide Schottky diodes for millimeter wave detection and
 frequency mixing)

REFERENCE COUNT: 21 THERE ARE 21 CITED REFERENCES AVAILABLE FOR
 THIS RECORD. ALL CITATIONS AVAILABLE IN THE
 RE FORMAT

L57 ANSWER 6 OF 49 HCAPLUS COPYRIGHT 2007 ACS on STN
 ACCESSION NUMBER: 2002:368853 HCAPLUS Full-text
 DOCUMENT NUMBER: 136:378422

TITLE: Epitaxial growth of nitride compound semiconductor having reduced dislocation d.
 INVENTOR(S): Tsai, Tzong-Liang; Chang, Chih-Sung
 PATENT ASSIGNEE(S): United Epitaxy Company, Ltd., Taiwan
 SOURCE: U.S. Pat. Appl. Publ., 12 pp.
 CODEN: USXXCO
 DOCUMENT TYPE: Patent
 LANGUAGE: English
 FAMILY ACC. NUM. COUNT: 1
 PATENT INFORMATION:

PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
US 2002056840	A1	20020516	US 2000-750351	20001229
			<--	
US 6462357	B2	20021008		
US 6504183	B1	20030107	US 2000-659015	20000908
			<--	
TW 486829	B	20020511	TW 2000-89124233	20001116
			<--	
JP 2002170991	A	20020614	JP 2001-11695	20010119
			<--	
JP 3778344	B2	20060524		
US 2003071276	A1	20030417	US 2002-292712	20021113
			<--	
US 6774410	B2	20040810		
PRIORITY APPLN. INFO.:			TW 2000-89124233	A 20001116
			<--	
			US 2000-659015	A3 20000908
			<--	

ED Entered STN: 18 May 2002

AB The present invention provides materials and structures to reduce dislocation d. when growing a III-nitride compound semiconductor. A II-nitride compound single crystal-island layer is included in the semiconductor structure, and III-nitride compound semiconductor layers are to grow thereon. It reduces the dislocation d. resulted from the difference between the lattice consts. of the GaN compound semiconductor layers and the substrate. It also improves the crystallization property of the III-nitride compound semiconductor.

IT 409-21-2, Silicon carbide (SiC),
 processes
 (substrate; epitaxy of III-nitride compound semiconductor
 device having reduced dislocation d. by including II-nitride compound
 layer)

RN 409-21-2 HCAPLUS

CN Silicon carbide (SiC) (CA INDEX NAME)

*** STRUCTURE DIAGRAM IS NOT AVAILABLE ***

IC ICM H01L031-12

ICS H01L031-0312; H01L031-032; H01L031-0328

INCL 257078000

CC 76-3 (Electric Phenomena)

Section cross-reference(s): 73, 75

IT Semiconductor materials

(nitrides; epitaxy of III-nitride compound semiconductor device
 having reduced dislocation d. by including II-nitride compound layer)

IT 7440-31-5, Tin, uses 7440-56-4, Germanium, uses 13494-80-9,

Tellurium, uses

(dopant of n-type III-nitrides;
 epitaxy of III-nitride compound semiconductor device having reduced
 dislocation d. by including II-nitride compound layer)

- IT 7439-95-4, Magnesium, uses 7440-43-9, Cadmium, uses 7440-66-6, Zinc, uses
(dopant of p-type III-nitrides;
epitaxy of III-nitride compound semiconductor device having reduced dislocation d. by including II-nitride compound layer)
- IT 1304-54-7, Beryllium nitride (Be3N2) 1313-49-1, Zinc nitride (Zn3N2) 12013-82-0, Calcium nitride (Ca3N2) 12033-82-8, Strontium nitride (Sr3N2) 12047-79-9, Barium nitride (Ba3N2) 12057-71-5, Magnesium nitride (Mg3N2) 12136-15-1, Mercury nitride (Hg3N2) 12380-95-9, Cadmium nitride (Cd3N2) 24304-00-5, Aluminum nitride (AlN) 25617-97-4, Gallium nitride (GaN) 25617-98-5, Indium nitride 106097-44-3, Aluminum gallium nitride (AlGaIn) 120994-22-1, Aluminum indium nitride (AlInN) 120994-23-2, Gallium indium nitride (GaInN) 127575-65-9, Aluminum gallium indium nitride (Al,Ga,In)N
(epitaxy of III-nitride compound semiconductor device having reduced dislocation d. by including II-nitride compound layer)
- IT 7440-21-3, Silicon, processes
(substrate and dopant of n-type III-nitrides; epitaxy of III-nitride compound semiconductor device having reduced dislocation d. by including II-nitride compound layer)
- IT 409-21-2, Silicon carbide (SiC), processes 1303-00-0, Gallium arsenide (GaAs), processes 1344-28-1, Aluminum oxide (Al2O3), processes
(substrate; epitaxy of III-nitride compound semiconductor device having reduced dislocation d. by including II-nitride compound layer)

L57 ANSWER 7 OF 49 HCAPLUS COPYRIGHT 2007 ACS on STN

ACCESSION NUMBER: 2002:666856 HCAPLUS [Full-text](#)

DOCUMENT NUMBER: 137:317655

TITLE: Semiconductor ultraviolet-radiation sensors
employing rectifying electrode made of
high-melting metal with surface on irradiated side
covered with silver light filter

INVENTOR(S): Afanas'ev, A. V.; Il'in, V. A.; Petrov, A. A.

PATENT ASSIGNEE(S): Tsentr Tekhnologii Mikroelektroniki, Russia

SOURCE: Russ., No pp. given

CODEN: RUXXE7

DOCUMENT TYPE: Patent

LANGUAGE: Russian

FAMILY ACC. NUM. COUNT: 1

PATENT INFORMATION:

PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
RU 2178601	C1	20020120	RU 2001-109604	20010412
			<--	
PRIORITY APPLN. INFO.:			RU 2001-109604	20010412
			<--	

ED Entered STN: 04 Sep 2002

AB Semiconductor sensors for selective detection of UV radiation in the 280-340 nm range are described which comprise a substrate made of n+-type silicon carbide single crystal with an n- type epitaxial layer, an electrode connected to the n+-region of the substrate, an insulating coating deposited on the n- type layer at the irradiated side of the substrate, a rectifying electrode connected to the n-layer of the substrate through a window made in the insulating layer to form a Schottky-barrier contact; and a terminal contact connected to the rectifying electrode for its connection to external elec.

circuit and for applying bias voltage between the electrodes; where the rectifying electrode has a thickness of 4-10 nm and is made of a high-melting contact metal with m.p. ≥ 1877 °C; the rectifying electrode surface on the irradiated side is covered with a Ag light filter, 8-15 nm in thickness; the rectifying electrode is connected to the n-layer of the substrate through an intermediate metal carbide layer with thickness 1-7 nm containing the same metal as the rectifying electrode. UV detectors employing various metals as rectifying electrodes were characterized with an optimal performance from a detector employing tungsten electrode.

IT 409-21-2, Silicon carbide, uses
 (nitrogen-doped single crystal
 substrate; selective semiconductor UV detectors employing
 rectifying electrode made of high-melting metal with surface on
 irradiated side covered with silver light filter)

RN 409-21-2 HCAPLUS

CN Silicon carbide (SiC) (CA INDEX NAME)

*** STRUCTURE DIAGRAM IS NOT AVAILABLE ***

IT 7429-90-5, Aluminum, properties
 (rectifying electrode; selective semiconductor UV detectors
 employing rectifying electrode made of high-melting metal with
 surface on irradiated side covered with silver light filter)

RN 7429-90-5 HCAPLUS

CN Aluminum (CA INDEX NAME)

Al

IC ICM H01L031-09

CC 73-11 (Optical, Electron, and Mass Spectroscopy and Other Related Properties)
 Section cross-reference(s): 76

IT 1299-86-1P, Aluminum carbide 11113-78-3P, Palladium
 silicide 11129-80-9P, Platinum silicide 11130-49-7P, Chromium
 carbide 12070-06-3P, Tantalum carbide 12070-12-1P, Tungsten
 carbide 12627-57-5P, Molybdenum carbide 39467-10-2P, Nickel
 silicide
 (intermediate layer; selective semiconductor UV detectors employing
 rectifying electrode made of high-melting metal with surface on
 irradiated side covered with silver light filter)

IT 409-21-2, Silicon carbide, uses
 (nitrogen-doped single crystal
 substrate; selective semiconductor UV detectors employing
 rectifying electrode made of high-melting metal with surface on
 irradiated side covered with silver light filter)

IT 7429-90-5, Aluminum, properties 7439-98-7,
 Molybdenum, properties 7440-05-3, Palladium, properties 7440-06-4,
 Platinum, properties 7440-25-7, Tantalum, properties 7440-33-7,
 Tungsten, properties
 (rectifying electrode; selective semiconductor UV detectors
 employing rectifying electrode made of high-melting metal with
 surface on irradiated side covered with silver light filter)

IT 17778-88-0, Nitrogen, atomic, uses
 (silicon carbide doped with;
 selective semiconductor UV detectors employing rectifying electrode
 made of high-melting metal with surface on irradiated side covered
 with silver light filter)

L57 ANSWER 8 OF 49 HCAPLUS COPYRIGHT 2007 ACS on STN
 ACCESSION NUMBER: 2002:889817 HCAPLUS Full-text
 DOCUMENT NUMBER: 137:361346
 TITLE: Growth method of gallium nitride series compound semiconductor with amorphous and polycrystalline structure
 INVENTOR(S): Zhao, Rujie
 PATENT ASSIGNEE(S): Peop. Rep. China
 SOURCE: Faming Zhuanli Shenqing Gongkai Shuomingshu, 9 pp.
 CODEN: CNXXEV
 DOCUMENT TYPE: Patent
 LANGUAGE: Chinese
 FAMILY ACC. NUM. COUNT: 1
 PATENT INFORMATION:

PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
CN 1322006	A	20011114	CN 2000-106194	20000430

PRIORITY APPLN. INFO.: CN 2000-106194 20000430
 <-->

ED Entered SIN: 25 Nov 2002

AB The growth method comprises: (1) vapor phase growing an amorphous and/or polycrystal semiconductor layer .apprx.1.00Å on sapphire, gallium nitride, silicon, silicon carbide or gallium arsenide substrate at 180-1100°. Vapor phase epitaxial growing another amorphous and/or polycrystal semiconductor layer with same structure component of the 1st layer, and same or different stoichiometry, on the 1st layer at 180-1200°. The 3rd amorphous and/or polycrystal semiconductor layer can be grown on the 2nd layer. The 1-type, P-type and/or N-type impurities (concentration = 1014-22 EA/cm3) can be doped in these layer. The P-type impurity is selected from Zn, Mg, Be, Sr and/or Cd. The N-type impurity is selected from Si, Ge, Sn, S and/or Se. The gases for vapor phase growing contains ammonia, diamine, trimethylamino-aluminum, trimethyl-gallium, triethyl-gallium, diethyl-zinc, trimethyl-zinc, trimethyl-indium or cyclopentadienyl- magnesium as required.

IC ICM H01L021-20

ICS H01L033-00

CC 76-3 (Electric Phenomena)

Section cross-reference(s): 75

IT Amorphous semiconductors

Crystal growth

Ion implantation

Vapor phase epitaxy

(epitaxial growth method of gallium nitride series compound semiconductor with amorphous and polycryst. structure)

IT 7439-95-4, Magnesium, properties 7440-21-3, Silicon, properties

7440-24-6, Strontium, properties 7440-31-5, Tin, properties

7440-41-7, Beryllium, properties 7440-43-9, Cadmium, properties

7440-56-4, Germanium, properties 7440-66-6, Zinc, properties

7704-34-9, Sulfur, properties 7782-49-2, Selenium, properties

(dopant; epitaxial growth method of gallium nitride series compound semiconductor with amorphous and polycryst. structure)

IT 557-20-0, Diethyl-zinc 1115-99-7, Triethyl-gallium 1284-72-6,

BisCyclopentadienyl-magnesium 1445-79-0, Trimethyl-gallium

3385-78-2, Trimethyl-indium 100111-88-4

(dopant; epitaxial growth method of gallium nitride series compound semiconductor with amorphous and polycryst. structure)

IT 25617-97-4P, Gallium nitride 127575-65-9P, Aluminum
gallium indium nitride
(epitaxial growth method of gallium nitride series compound
semiconductor with amorphous and polycryst. structure)

L57 ANSWER 9 OF 49 HCAPLUS COPYRIGHT 2007 ACS on STN

ACCESSION NUMBER: 2000:870840 HCAPLUS Full-text

DOCUMENT NUMBER: 134:229964

TITLE: Fabrication and performance of GaN electronic
devices

AUTHOR(S): Pearton, S. J.; Ren, F.; Zhang, A. P.; Lee, K. P.

CORPORATE SOURCE: Department of Materials Science and Engineering,
University of Florida, Gainesville, FL, 32611, USA

SOURCE: Materials Science & Engineering, R: Reports (2000), R30(3-6), 55-212
CODEN: MIGIEA; ISSN: 0927-796X

PUBLISHER: Elsevier Science S.A.

DOCUMENT TYPE: Journal; General Review

LANGUAGE: English

ED Entered STN: 13 Dec 2000

AB A review with 306 refs. GaN and related materials (especially AlGaN) have recently attracted a lot of interest for applications in high power electronics capable of operation at elevated temps. Although the growth and processing technol. for SiC, the other viable wide bandgap semiconductor material, is more mature, the AlGaInN system offers numerous advantages. These include wider band gaps, good transport properties, the availability of heterostructures (particularly AlGaN/GaN), the experience base gained by the commercialization of GaN-based laser and light-emitting diodes and the existence of a high growth rate epitaxial method (hydride vapor phase epitaxy) for producing very thick layers or even quasi- substrates. These attributes have led to rapid progress in the realization of a broad range of GaN electronic devices, including heterostructure field effect transistors (HFETs), Schottky and p-n rectifiers, heterojunction bipolar transistors (HBTs), bipolar junction transistors (BJTs) and metal-oxide semiconductor field effect transistors (MOSFETs). This review focuses on the development of fabrication processes for these devices and the current state-of-the-art in device performance, for all of these structures. We also detail areas where more work is needed, such as reducing defect densities and purity of epitaxial layers, the need for substrates and improved oxides and insulators, improved p-type doping and contacts and an understanding of the basic growth mechanisms.

CC 76-0 (Electric Phenomena)

Section cross-reference(s): 75

IT Bipolar transistors

Crystal defects

Doping

Electric contacts

Epitaxial films

Epitaxy

Field effect transistors

Heterojunction bipolar transistors

Heterojunction semiconductor devices

MOSFET (transistors)

Schottky diodes

Semiconductor devices

(fabrication and performance of GaN electronic devices)

IT 25617-97-4, Gallium nitride 106097-44-3, Aluminum gallium
nitride (Al,Ga)N 127575-65-9, Aluminum gallium
indium nitride (Al,Ga,In)N

(fabrication and performance of GaN electronic devices)

REFERENCE COUNT: 307 THERE ARE 307 CITED REFERENCES AVAILABLE FOR THIS RECORD. ALL CITATIONS AVAILABLE IN THE RE FORMAT

L57 ANSWER 10 OF 49 HCAPLUS COPYRIGHT 2007 ACS on STN
 ACCESSION NUMBER: 1999:780330 HCAPLUS Full-text
 DOCUMENT NUMBER: 132:28419
 TITLE: Planar technology for producing light-emitting devices
 INVENTOR(S): Maruska, H. Paul
 PATENT ASSIGNEE(S): Implant Sciences Corporation, USA
 SOURCE: U.S., 18 pp.
 CODEN: USXXAM
 DOCUMENT TYPE: Patent
 LANGUAGE: English
 FAMILY ACC. NUM. COUNT: 1
 PATENT INFORMATION:

PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
US 5998232	A	19991207	US 1999-231689	19990114

PRIORITY APPLN. INFO.: US 1998-71619P P 19980116
 <--

ED Entered STN: 09 Dec 1999

AB Methods for producing a semiconductor device suitable for use as a light-emitting diode or laser diode are described which entail providing a transparent substrate capable of supporting single crystal nitride growth having disposed sequentially thereon a first layer of an n-type doped first nitride compound, ≥ 1 addnl. (undoped) layer comprising a second nitride compound or a nitride alloy, and a final topmost layer of an undoped third nitride compound; applying an n-type dopant to a peripheral portion of the topmost layer by ion implantation under conditions selected so that the n-type dopant permeates through the topmost layer and at least a portion of the addnl. layer, forming an implanted n-type region; and applying a p-type dopant to a central region of the top-most layer by ion implantation under conditions such that the p-type dopant permeates through the topmost layer, forming a p-type implanted region. The substrate may be selected from sapphire, spinel, and silicon carbide.

IT 409-21-2, Silicon carbide, uses
 (planar technol. for producing light-emitting devices)

RN 409-21-2 HCAPLUS

CN Silicon carbide (SiC) (CA INDEX NAME)

*** STRUCTURE DIAGRAM IS NOT AVAILABLE ***

IC ICM H01L021-00

INCL 438046000

CC 73-10 (Optical, Electron, and Mass Spectroscopy and Other Related Properties)

Section cross-reference(s): 76

IT 409-21-2, Silicon carbide, uses

1116-21-5, Yttrium nitride 12068-51-8, Magnesium aluminate
 (Mg(AlO₂)₂) 24304-00-5, Aluminum nitride 25617-97-4,
 Gallium nitride 25617-98-5, Indium nitride 56627-57-7, Scandium
 nitride 62169-71-5, Thallium nitride 120994-23-2, Indium gallium
 nitride 175295-28-0, Lanthanum nitride

(planar technol. for producing light-emitting devices)

REFERENCE COUNT: 8 THERE ARE 8 CITED REFERENCES AVAILABLE FOR THIS RECORD. ALL CITATIONS AVAILABLE IN THE RE FORMAT

L57 ANSWER 11 OF 49 HCAPLUS COPYRIGHT 2007 ACS on STN
 ACCESSION NUMBER: 1999:655150 HCAPLUS Full-text
 DOCUMENT NUMBER: 131:344782
 TITLE: Annealing of ion implantation damage in
 SiC using a graphite mask
 AUTHOR(S): Thomas, Chris; Taylor, Crawford; Griffin, James;
 Rose, William L.; Spencer, M. G.; Capano, Mike;
 Rendakova, S.; Kornegay, Kevin
 CORPORATE SOURCE: Materials Science Research Center of Excellence,
 Howard University, Washington, DC, 20059, USA
 SOURCE: Materials Research Society Symposium Proceedings (1999), 572(Wide-Bandgap Semiconductors for
 High-Power, High-Frequency and High-Temperature
 Applications), 45-50
 CODEN: MRSPDH; ISSN: 0272-9172
 PUBLISHER: Materials Research Society
 DOCUMENT TYPE: Journal
 LANGUAGE: English

ED Entered STN: 15 Oct 1999

AB For p-type ion implanted SiC, temps. in excess of 1600 °C are required to activate the dopant atoms and to reduce the crystal damage inherent in the implantation process. At these high temps., however, macrosteps (periodic welts) develop on the SiC surface. In this work, we investigate the use of a graphite mask as an anneal cap to eliminate the formation of macrosteps. N-type 4H- and 6H-SiC epilayers, both ion implanted with low energy (keV) Boron (B) schedules at 600 °C, and 6H-SiC substrates, ion implanted with Aluminum (Al), were annealed using a Graphite mask as a cap. The anneals were done at 1660 °C for 20 and 40 min. Atomic force microscopy (AFM), capacitance-voltage (C-V) and secondary ion mass spectrometry (SIMS) measurements were then taken to investigate the effects of the anneal on the surface morphol. and the substitutional activation of the samples. It is shown that, by using the Graphite cap for the 1660 °C anneals, neither polytype developed macrosteps for any of the dopant elements or anneal times. The substitutional activation of Boron in 6H-SiC was about 15%.

IT 409-21-2, Silicon carbide (SiC),
 properties
 (annealing of ion implantation damage in SiC using a
 graphite mask)

RN 409-21-2 HCAPLUS

CN Silicon carbide (SiC) (CA INDEX NAME)

*** STRUCTURE DIAGRAM IS NOT AVAILABLE ***

CC 76-3 (Electric Phenomena)

ST silicon carbide ion implantation damage annealing
 graphite mask

IT Annealing

Dopants

Epitaxial films

Ion implantation

Surface structure

(annealing of ion implantation damage in SiC using a
 graphite mask)

IT 409-21-2, Silicon carbide (SiC),
 properties

(annealing of ion implantation damage in SiC using a
 graphite mask)

IT 7782-42-5, Graphite, properties

(mask; annealing of ion implantation damage in SiC using
 a graphite mask)

REFERENCE COUNT: 6 THERE ARE 6 CITED REFERENCES AVAILABLE FOR THIS RECORD. ALL CITATIONS AVAILABLE IN THE RE FORMAT

L57 ANSWER 12 OF 49 HCAPLUS COPYRIGHT 2007 ACS on STN

ACCESSION NUMBER: 1998:623248 HCAPLUS [Full-text](#)

DOCUMENT NUMBER: 129:296860

TITLE: Doping of GaN by ion implantation: does it work?

AUTHOR(S): Suvkhanov, A.; Hunn, J.; Wu, W.; Thomson, D.; Price, K.; Parikh, N.; Irene, E.; Davis, R. F.; Krasnobayev, L.

CORPORATE SOURCE: Department of Physics & Astronomy, University of North Carolina, Chapel Hill, NC, 27599, USA

SOURCE: Materials Research Society Symposium Proceedings (1998), 512(Wide-Bandgap Semiconductors for High Power, High Frequency and High Temperature), 475-480

CODEN: MRSPDH; ISSN: 0272-9172

PUBLISHER: Materials Research Society

DOCUMENT TYPE: Journal

LANGUAGE: English

ED Entered STN: 02 Oct 1998

AB Epitaxially grown GaN by metal organic chemical vapor deposition (MOCVD) on SiC were implanted with 100 keV Si⁺ (for n-type) and 80 keV Mg⁺ (for p-type) with various fluences from 1 + 10¹² to 7 + 10¹⁵ ions/cm² at liquid nitrogen temperature (LT), room temperature (RT), and 700 °C (HT). High temperature (1200 °C and 1500 °C) annealing was carried out after capping the GaN with epitaxial AlN by MOCVD to study damage recovery. Samples were capped by a layer of AlN in order to protect the GaN surface during annealing. Effects of implant temperature, damage and dopant activation are critically studied to evaluate a role of ion implantation in doping of GaN. The damage was studied by Rutherford Backscattering/Channeling, spectroscopic ellipsometry and photoluminescence. Results show dependence of radiation damage level on temperature of the substrate during implantation: implantations at elevated temps. up to 550 °C decrease the lattice disorder; "hot implants" above 550 °C can not be useful in doping of GaN due to nitrogen loss from the surface. SE measurements have indicated very high sensitivity to the implantation damage. PL measurements at LT of 80 keV Mg⁺ (5 + 10¹⁴ cm⁻²) implanted and annealed GaN showed two peaks: one .apprx.100 meV and another .apprx.140 meV away from the band edge.

IT 409-21-2, Silicon carbide (SiC), properties
(substrate; doping of GaN by ion implantation: does it work)

RN 409-21-2 HCAPLUS

CN Silicon carbide (SiC) (CA INDEX NAME)

*** STRUCTURE DIAGRAM IS NOT AVAILABLE ***

CC 76-3 (Electric Phenomena)

Section cross-reference(s): 75

ST gallium nitride epitaxy doping ion implantation

IT Annealing

Doping

Electric activation (dopants)

Ellipsometry

Epitaxy

Ion implantation

Luminescence

Radiation damage

Rutherford backscattering
(doping of GaN by ion implantation: does it work)

IT Band structure
(edge; doping of GaN by ion implantation: does it work)

IT Crystal structure
(lattice disorders; doping of GaN by ion implantation: does it work)

IT Vapor deposition process
(metalorg.; doping of GaN by ion implantation: does it work)

IT 24304-00-5, Aluminum nitride (AlN)
(capping of gallium nitride samples with; doping of GaN by ion implantation: does it work)

IT 7439-95-4, Magnesium, uses
(dopant; doping of GaN by ion implantation: does it work)

IT 25617-97-4P, Gallium nitride (GaN)
(doping of GaN by ion implantation: does it work)

IT 403-21-2, Silicon carbide (SiC),
properties
(substrate; doping of GaN by ion implantation: does it work)

REFERENCE COUNT: 17 THERE ARE 17 CITED REFERENCES AVAILABLE FOR THIS RECORD. ALL CITATIONS AVAILABLE IN THE RE FORMAT

L57 ANSWER 13 OF 49 HCAPLUS COPYRIGHT 2007 ACS on STN

ACCESSION NUMBER: 1997:452017 HCAPLUS Full-text

DOCUMENT NUMBER: 127:183462

TITLE: Single crystal growth of SiC
and electronic devices

AUTHOR(S): Itoh, Akira; Matsunami, Hiroyuki

CORPORATE SOURCE: Tokyo Institute of Technology, Kyoto University,
Kyoto, 606-01, Japan

SOURCE: Critical Reviews in Solid State and Materials
Sciences (1997), 22(2), 111-197
CODEN: CCRSDA; ISSN: 1040-8436

PUBLISHER: CRC

DOCUMENT TYPE: Journal; General Review

LANGUAGE: English

ED Entered STN: 19 Jul 1997

AB Single crystal growth of Si carbide (SiC) and application to electronic devices are reviewed with 144 refs. In the crystal growth, bulk and homoepitaxial growth are picked up, and crystal quality and elec. properties are described. For electronic devices, various device processes are argued. Power devices based on SiC are stressed in this review. Bulk single crystals of SiC can be grown by a sublimation method, and large-area 6H-SiC and 4H-SiC single crystals were obtained. The occurrence of SiC polytypes is affected by the growth condition, and can be controlled successfully by optimizing these conditions. 6H-SiC is grown on 6H-SiC (0001) Si-faces, and 4H-SiC on 6H-SiC (0001.hivin.1) C-faces. The crystallinity of bulk crystals was studied by RHEED and x-ray anal., and characterization is carried out in detail by optical and elec. measurement. Successful homoepitaxial vapor phase growth of SiC can be realized using off-axis {0001} substrates prepared by a sublimation method called step-controlled epitaxy. Since the crystallinity of epilayers is improved during the step-controlled epitaxy, this growth technique is a key for getting high-quality crystal surfaces. Impurity doping is controlled during homoepitaxial growth by employing impurity gases, such as N₂, trimethylaluminum (TMA), and B₂H₆. A wide-range of carrier concns. of 5 + 1013.apprx.3 + 1018 cm⁻³ for n- type and 5 + 1016.apprx.3 + 1020 cm⁻³ for p-

type are realized. The impurity-incorporation mechanism in the step-controlled epitaxy is discussed based on the C/Si ratio dependence of impurity doping. Elec. properties of SiC grown by step-controlled epitaxy are determined precisely. A high electron mobility of $720 \text{ cm}^2/\text{Vs}$ was obtained in an undoped 4H- SiC epilayer with an electron concentration of $2.5 \times 10^{16} \text{ cm}^{-3}$ at 300 K. This electron mobility is about two times higher than that of 6H- SiC (.apprx.380 cm^2/Vs). High breakdown fields of $1\text{--}5 \times 10^6 \text{ V/cm}$ were obtained for both 6H- and 4H-SiC, one order of magnitude higher than those for Si. A high saturation electron drift velocity of $1.6 \times 10^7 \text{ cm/s}$ was obtained in 4H-SiC, which may make possible high performance of high-frequency 4H- SiC power devices. Impurity levels and deep levels were studied by Hall effect, admittance spectroscopy, and DLTS measurement. Metal/4H-SiC Schottky barrier heights were characterized and a strong dependence on metal work function without strong pinning is elucidated. Device processes are described for ion implantation. Interface properties of SiO₂/SiC were characterized in detail using metal-oxide-semiconductor (MOS) structure devices. Power electronic applications of SiC for high-voltage junction devices, MOS field effect transistors (FETs), and high-frequency devices are introduced. An optimum design for high-voltage 4H- SiC Schottky rectifiers is described, and high performance obtained exptl. is demonstrated.

IT 409-21-2, Silicon carbide (SiC),
properties
(single crystal growth of SiC for electronic
devices)
RN 409-21-2 HCAPLUS
CN Silicon carbide (SiC) (CA INDEX NAME)

*** STRUCTURE DIAGRAM IS NOT AVAILABLE ***

CC 75-0 (Crystallography and Liquid Crystals)
Section cross-reference(s): 76

ST review growth silicon carbide electronic device

IT Field effect transistors
(MOS; of silicon carbide single
crystals and epitaxial films for electronic devices)

IT Semiconductor devices
(high-voltage; of silicon carbide single
crystals and epitaxial films for electronic devices)

IT Vapor phase epitaxy
(of silicon carbide for electronic devices)

IT Electric properties
(of silicon carbide single crystals
and epitaxial films for electronic devices)

IT Crystal growth
Electric apparatus
(single crystal growth of SiC for electronic
devices)

IT 409-21-2, Silicon carbide (SiC),
properties
(single crystal growth of SiC for electronic
devices)

L57 ANSWER 14 OF 49 HCAPLUS COPYRIGHT 2007 ACS on STN
ACCESSION NUMBER: 1997:611183 HCAPLUS [Full-text](#)
DOCUMENT NUMBER: 127:300980
TITLE: Developing nitride-based blue LEDs on SiC
substrates
AUTHOR(S): Edmond, John; Lagaly, Jeffrey
CORPORATE SOURCE: Cree Res., Durham, NC, 27713, USA
SOURCE: JOM (1997), 49(9), 24-26
CODEN: JOMMER; ISSN: 1047-4838

PUBLISHER: Minerals, Metals & Materials Society
 DOCUMENT TYPE: Journal
 LANGUAGE: English
 ED Entered STN: 25 Sep 1997

AB Blue light-emitting diodes (LEDs) have consistently increased in brightness as devices have evolved from the homojunction SiC device to the double heterojunction GaN-based LED on SiC substrates. These LEDs are used in a wide range of applications requiring blue, white, and/or a combination of colors. The technol. to develop the nitride devices involves growing single-crystal thin films with compns. from AlN-InN-GaN via metalorg. CVD on single-crystal 6H-SiC substrates. AlGaIn containing high and low fractions of Al was grown directly on the SiC for use as a buffer layer. Subsequent epitaxial layers of GaN and AlGaIn were doped with Mg and Si to achieve p-type and n-type conductivity, resp. N-type InGaIn layers with In compns. up to .apprx.50% were also achieved.

IT 409-21-2D, Silicon carbide, hydrogenated
 (developing nitride-based blue LEDs on SiC
 substrates)

RN 409-21-2 HCAPLUS

CN Silicon carbide (SiC) (CA INDEX NAME)

*** STRUCTURE DIAGRAM IS NOT AVAILABLE ***

CC 73-11 (Optical, Electron, and Mass Spectroscopy and Other Related Properties)

Section cross-reference(s): 76

ST nitride LED silicon carbide substrate

IT Electroluminescent devices
 (developing nitride-based blue LEDs on SiC
 substrates)

IT Nitrides
 (developing nitride-based blue LEDs on SiC
 substrates)

IT Vapor deposition process
 (metalorg.; developing nitride-based blue LEDs on SiC
 substrates)

IT Electric current-potential relationship
 (of GaN:SiC blue LED)

IT Luminescence
 (of undoped and magnesium-doped GaN and InGaIn)

IT 409-21-2D, Silicon carbide, hydrogenated
 25617-97-4, Gallium nitride 106097-44-3, Aluminum gallium
 nitride ((Al,Ga)N) 120994-23-2, Indium gallium nitride
 (developing nitride-based blue LEDs on SiC
 substrates)

REFERENCE COUNT: 3 THERE ARE 3 CITED REFERENCES AVAILABLE FOR
 THIS RECORD. ALL CITATIONS AVAILABLE IN THE
 RE FORMAT

L57 ANSWER 15 OF 49 HCAPLUS COPYRIGHT 2007 ACS on STN

ACCESSION NUMBER: 1997:2974 HCAPLUS Full-text

DOCUMENT NUMBER: 126:39372

TITLE: Semiconductor laser with long service life and
 high reliability

INVENTOR(S): Paaburutsuku, Piitaa; Ishikawa, Masayuki;
 Nishikawa, Yukie

PATENT ASSIGNEE(S): Tokyo Shibaura Electric Co, Japan

SOURCE: Jpn. Kokai Tokkyo Koho, 10 pp.

CODEN: JKXXAF

DOCUMENT TYPE: Patent

LANGUAGE: Japanese

FAMILY ACC. NUM. COUNT: 1
PATENT INFORMATION:

PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
JP 08264896	A	19961011	JP 1995-62487	19950322
			<--	
JP 3333346	B2	20021015	JP 1995-62487	19950322
			<--	

PRIORITY APPLN. INFO.:

ED Entered STN: 04 Jan 1997

AB The laser includes a wurtzite-type defectless layer with (0001) crystal plane on a substrate, and a zincblende- or cubic-type semiconductor layer with (111) crystal plane, on the defectless layer.

IT 409-21-2, Silicon carbide, uses
(wurtzite-type; semiconductor laser with long service life and high reliability)

RN 409-21-2 HCAPLUS

CN Silicon carbide (SiC) (CA INDEX NAME)

*** STRUCTURE DIAGRAM IS NOT AVAILABLE ***

IC ICM H01S003-18
ICS H01L021-20

CC 73-10 (Optical, Electron, and Mass Spectroscopy and Other Related Properties)
Section cross-reference(s): 76

IT 12442-27-2, Cadmium zinc sulfide
(Cl-doped, wurtzite-type; semiconductor laser with long service life and high reliability)

IT 59989-74-1, Zinc selenide sulfide (Zn(Se,S))
(Cl-doped; semiconductor laser with long service life and high reliability)

IT 56780-29-1, Cadmium zinc selenide sulfide ((Cd,Zn)(Se,S))
(N-doped, zincblende-type; semiconductor laser with long service life and high reliability)

IT 12626-36-7, Cadmium selenide sulfide
(N-doped, wurtzite-type; semiconductor laser with long service life and high reliability)

IT 409-21-2, Silicon carbide, uses
1306-23-6, Cadmium sulfide, uses 1306-24-7, Cadmium selenide, uses
1314-13-2, Zinc oxide, uses 1314-98-3, Zinc sulfide, uses
1345-09-1, Cadmium mercury sulfide 12213-76-2, Calcium zinc sulfide
24304-00-5, Aluminum nitride 25617-97-4, Gallium nitride
25617-98-5, Indium nitride 53809-60-2, Calcium zinc oxide
58169-94-1, Magnesium zinc oxide 106769-84-0, Cadmium selenide
telluride (Cd(Se,Te)) 107404-43-3, Cadmium mercury selenide
((Cd,Hg)Se) 112801-95-3, Cadmium zinc oxide ((Cd,Zn)O)
120994-23-2, Gallium indium nitride 125270-45-3, Magnesium zinc
sulfide ((Mg,Zn)S) 128744-74-1, Indium nitride phosphide
136821-29-9, Gallium arsenide nitride (Ga(As,N))
138161-91-8, Cadmium magnesium selenide ((Cd,Mg)Se) 144972-75-8,
Cadmium calcium sulfide ((Cd,Ca)S) 153796-83-9, Aluminum
arsenide nitride (Al(As,N)) 158346-21-5, Cadmium
zinc selenide 161353-59-9, Indium arsenide nitride (In(As,N))
171425-22-2, Cadmium magnesium sulfide ((Cd,Mg)S) 183266-64-0,
Aluminum indium nitride 184679-39-8, Cadmium oxide selenide
(Cd(O,Se)) 184679-43-4, Cadmium calcium selenide ((Cd,Ca)Se)
184679-50-3, Antimony gallium nitride (Sb0-1GaNO-1) 184679-51-4,
Aluminum antimony nitride (AlSb0-1InO-1) 184679-52-5,
Antimony indium nitride (Sb0-1InNO-1)

(wurtzite-type; semiconductor laser with long service life and high reliability)

IT 12063-98-8, Gallium phosphide, uses 107121-39-1, Aluminum indium phosphide (zincblende-type; semiconductor laser with long service life and high reliability)

L57 ANSWER 16 OF 49 HCAPLUS COPYRIGHT 2007 ACS on STN
 ACCESSION NUMBER: 1996:286809 HCAPLUS Full-text
 DOCUMENT NUMBER: 125:23208
 TITLE: Elevated temperature nitrogen implants in 6H-SiC
 AUTHOR(S): Gardner, Jason; Rao, Mulpuri V.; Holland, O. W.; Kelner, G.; Simons, David S.; Chi, Peter H.; Andrews, John M.; Kretchmer, J.; Ghezzi, M.
 CORPORATE SOURCE: Department Electrical Computer Engineering, George Mason University, Fairfax, VA, 22030, USA
 SOURCE: Journal of Electronic Materials (1996), 25(5), 885-892
 CODEN: JECMA5; ISSN: 0361-5235
 PUBLISHER: Minerals, Metals & Materials Society
 DOCUMENT TYPE: Journal
 LANGUAGE: English
 ED Entered STN: 15 May 1996
 AB Elevated temperature (700°) N ion implantations were performed into 6H-SiC in the energy range of 50 keV-4 MeV. By analyzing the as-implanted depth distributions, the range statistics of the N+ in 6H-SiC were established over this energy range. Annealing at 1500 and 1600° for 15 min resulted in Rutherford backscattering spectrometry scattering yields at the virgin crystal level, indicating a good recovery of the crystal quality of the material without any redistribution of the dopant. A maximum electron concentration of $2 \times 10^{19} \text{ cm}^{-3}$, at room temperature, was measured even for high-dose implants. The p-n junction diodes made by N ion implantation into a p-type substrate have a forward turn-on voltage of 2.2 V, an ideality factor of 1.90, and a reverse breakdown voltage of 125 V with nA range leakage current for -10 V bias at room temperature. By probing many devices on the same substrate the authors found uniform forward and reverse characteristics across the crystal.

IT 409-21-2, Silicon carbide (SiC), properties (elevated temperature nitrogen implants in 6H-SiC for p-n junction diodes)
 RN 409-21-2 HCAPLUS
 CN Silicon carbide (SiC) (CA INDEX NAME)

*** STRUCTURE DIAGRAM IS NOT AVAILABLE ***

IT 7727-37-9, Nitrogen, uses (elevated temperature nitrogen implants in 6H-SiC for p-n junction diodes)
 RN 7727-37-9 HCAPLUS
 CN Nitrogen (CA INDEX NAME)

CC 76-3 (Electric Phenomena)
 ST nitrogen implantation silicon carbide junction

- diode
IT Annealing
Diodes
(elevated temperature nitrogen implants in 6H-SiC for p-n junction diodes)
IT Electric current
(leakage, elevated temperature nitrogen implants in 6H-SiC for p-n junction diodes)
IT 409-21-2, Silicon carbide (SiC),
properties
(elevated temperature nitrogen implants in 6H-SiC for p-n junction diodes)
IT 7727-31-3, Nitrogen, uses
(elevated temperature nitrogen implants in 6H-SiC for p-n junction diodes)

L57 ANSWER 17 OF 49 HCAPLUS COPYRIGHT 2007 ACS on STN

ACCESSION NUMBER: 1996:161838 HCAPLUS [Full-text](#)

DOCUMENT NUMBER: 124:247308

TITLE: Growth via MOCVD and characterization of GaN and Al_xGa_{1-x}N(0001) alloys for optoelectronic and microelectronic device applications

AUTHOR(S): Davis, Robert F.; Weeks, T. W., Jr.; Bremser, M. D.; Ailey, K. S.; Perry, W. G.

CORPORATE SOURCE: Department Materials Science an Engineering, North Carolina State University, Raleigh, NC, 27607-7907, USA

SOURCE: Materials Research Society Symposium Proceedings (1996), 415(Metal-Organic Chemical Vapor Deposition of Electronic Ceramics II), 3-14
CODEN: MRSPDH; ISSN: 0272-9172

PUBLISHER: Materials Research Society

DOCUMENT TYPE: Journal

LANGUAGE: English

ED Entered STN: 20 Mar 1996

AB Monocryst. GaN(0001) thin films have been grown at 950° on high-temperature, 100-nm-thick, monocryst. AlN(0001) buffer layers previously deposited at 1100° on α (6H)-SiC (0001)Si substrates via MOCVD in a cold-wall, vertical, pancake-style reactor. Al_xGa_{1-x}N films ($0 \leq x \leq 1$) were grown directly on the same SiC surface at 1100°. Abrupt heterojunctions among the alloy composition were demonstrated. All films possessed a smooth surface morphol. and were free of low-angle grain boundaries and associated oriented domain microstructures. Double-crystal x-ray rocking curve measurements for the GaN(0004) reflection for simultaneously deposited 1.4 μ m films revealed FWHM values of 58 and 151 arcsec for materials grown on on-axis and off-axis material, resp. The corresponding values for the AlN(0004) buffer layers were \approx 200 and \approx 400 arc sec, resp. A similar relation was found for the alloys for $0 \leq x \leq 0.2$. The PL spectra of the GaN films deposited on both vicinal and on-axis substrates revealed strong bound exciton emission with a FWHM value of 4 meV. The spectra of these films on the vicinal substrates were shifted to a lower energy, indicative of films containing residual tensile stresses. A peak believed to be associated with free excitonic emission was also observed in each on-axis spectrum. Rutherford backscattering, Auger depth profiling, and energy dispersive anal. were used to determine the AlN/GaN ratios in the alloys. Cathodoluminescence of solns. with $x < 0.5$ exhibited strong near band edge emission with a FWHM as low as 31 meV. The band gaps were determined via spectral ellipsometry. Undoped GaN and Al_xGa_{1-x}N films were too resistive for accurate Hall-effect measurements. Controlled n-type Si doping in GaN and Al_xGa_{1-x}N (for $x \leq 0.4$) was achieved for net carrier concns. ranging from

approx. $2 \times 10^{17} \text{ cm}^{-3}$ to $2 \times 10^{19} (\text{AlxGal-xN})$ or to $1 \times 10^{20} (\text{GaN}) \text{ cm}^{-3}$. Mg-doped, p-type GaN was achieved with $n\text{-}n\text{D} \approx 3 \times 10^{17} \text{ cm}^{-3}$, $p \approx 7 \text{ } \Omega\text{-cm}$, and $\mu \approx 3 \text{ cm}^2/\text{V-s}$.

CC 76-3 (Electric Phenomena)

Section cross-reference(s): 73

ST MOCVD deposition aluminum gallium arsenide; microelectronic device aluminum gallium arsenide; optoelectronic device aluminum gallium arsenide

IT 106097-44-3, Aluminum gallium nitride ((Al,Ga)N)
(growth via MOCVD and characterization of AlxGal-xN(0001) alloys for optoelectronic and microelectronic device applications)

L57 ANSWER 18 OF 49 HCAPLUS COPYRIGHT 2007 ACS on STN

ACCESSION NUMBER: 1995:321225 HCAPLUS Full-text

DOCUMENT NUMBER: 122:175442

TITLE: Contact resistivity of Re, Pt and Ta films on n-type $\beta\text{-SiC}$: preliminary results

AUTHOR(S): Chen, J. S.; Baechli, A.; Nicolet, M.-A.; Baud, L.; Jaussaud, C.; Madar, R.

CORPORATE SOURCE: California Institute of Technology, Pasadena, CA, 91125, USA

SOURCE: Materials Science & Engineering, B: Solid-State Materials for Advanced Technology (1995), B29(1-3), 185-9
CODEN: MSBTEK; ISSN: 0921-5107

PUBLISHER: Elsevier

DOCUMENT TYPE: Journal

LANGUAGE: English

ED Entered STN: 01 Feb 1995

AB Contact resistivities of as-deposited and annealed Pt, Re and Ta films on n-type single-crystalline $\beta\text{-SiC}(001)$ were characterized using a circular contact pattern and the circular transmission-line model method. The $\beta\text{-SiC}$ substrates used in the experiment are n-type doped either nonintentionally to a carrier concentration of approx. 10^{17} cm^{-3} , or by N implantation and annealing to a concentration of $5 \times 10^{19} \text{ cm}^{-3}$. The effect of a finite resistance along the circular contact rings on the measured potentials is corrected with a resistance network model. On the nonintentionally doped $\beta\text{-SiC}$ substrates, Pt contacts are nonohmic regardless of the heat treatment. The as-deposited Ta and Re contacts are ohmic with contact resistivities of $5 \times 10^{-5} \text{ } \Omega \text{ cm}^2$ and $4 \times 10^{-4} \text{ } \Omega \text{ cm}^2$ resp. Upon annealing at 500° for 30 min, the resistivity of Ta increases slightly while that of Re decreases slightly. Both Ta and Re contacts become nonohmic by annealing at 900° for 30 min. The as-deposited Ta, Pt and Re contacts are all ohmic on the N-implanted $\beta\text{-SiC}$ substrate. The contact resistivity of the as-deposited Ta contact is the lowest and in the order of high $10^{-7} \text{ } \Omega \text{ cm}^2$, stays about the same at 500° and degrades to $4.3 \times 10^{-6} \text{ } \Omega \text{ cm}^2$ at 1000° . The as-deposited Re contact has the highest contact resistivity of $1 \times 10^{-4} \text{ } \Omega \text{ cm}^2$ but it improves to $1 \times 10^{-5} \text{ } \Omega \text{ cm}^2$ upon annealing at 900° . The contact resistivity of the as-deposited Pt contacts is $6 \times 10^{-6} \text{ } \Omega \text{ cm}^2$ and increases to $1 \times 10^{-5} \text{ } \Omega \text{ cm}^2$ at 500° . After annealing at 900° for 30 min, the Pt contact on the N-implanted $\beta\text{-SiC}$ is no longer ohmic. The results are compared with the reactions that take place in those systems.

IT 409-21-2, Silicon carbide (SiC), properties

(contact resistivity of as-deposited and annealed Re, Pt and Ta films on n-type $\beta\text{-SiC}$)

RN 409-21-2 HCAPLUS

CN Silicon carbide (SiC) (CA INDEX NAME)

*** STRUCTURE DIAGRAM IS NOT AVAILABLE ***

IT 7727-37-9, Nitrogen, uses
(dopant; contact resistivity of as-deposited and annealed
Re, Pt and Ta films on n-type β -
SiC)

RN 7727-37-9 HCAPLUS

CN Nitrogen (CA INDEX NAME)



CC 76-2 (Electric Phenomena)

ST rhenium platinum tantalum contact silicon carbide;
resistivity contact rhenium platinum tantalum film

IT Annealing

Electric contacts

(contact resistivity of as-deposited and annealed Re, Pt and Ta
films on n-type β -SiC)

IT Electric resistance

(contact, contact resistivity of as-deposited and annealed Re, Pt
and Ta films on n-type β -SiC)

IT 7440-06-4, Platinum, properties 7440-15-5, Rhenium, properties

7440-25-7, Tantalum, properties

(contact resistivity of as-deposited and annealed Re, Pt and Ta
films on n-type β -SiC)

IT 409-21-2, Silicon carbide (SiC),
properties

(contact resistivity of as-deposited and annealed Re, Pt and Ta
films on n-type β -SiC)

IT 7727-37-9, Nitrogen, uses

(dopant; contact resistivity of as-deposited and annealed
Re, Pt and Ta films on n-type β -
SiC)

L57 ANSWER 19 OF 49 HCAPLUS COPYRIGHT 2007 ACS on STN

ACCESSION NUMBER: 1995:133452 HCAPLUS Full-text

DOCUMENT NUMBER: 122:120099

TITLE: Bulk crystals, thin films and devices of
the wide band gap semiconductors of
silicon carbide and the III-V
nitrides of aluminum, gallium and indium
Davis, Robert F.

AUTHOR(S):
CORPORATE SOURCE: North Carolina State Univ., Raleigh, NC,
27695-7907, USA

SOURCE: Institute of Physics Conference Series (1994), 137(Silicon Carbide and Related
Materials), 1-6

CODEN: IPCSEP; ISSN: 0951-3248

DOCUMENT TYPE: Journal

LANGUAGE: English

ED Entered STN: 08 Nov 1994

AB The extremes in the thermal and electronic properties of SiC and the III-V
nitrides of B, Al, Ga and In allow the types and the nos. of present and

conceivable device applications in these materials to be substantial. Single crystal boules and wafers of the 6H- and 4H-SiC polytypes were produced. However, micropipes and related defects cause device degradation. Mol. beam and atomic layer epitaxial thin film growth techniques and new devices have recently been reported. GaN continues to be heavily studied; however, n- and p-type doping and alloys with AlN and InN and associated heterostructures are now being studied to produce blue LEDs. Recent developments, current problems and required materials research are discussed in the following sections.

IT 409-21-2, Silicon carbide (SiC),
uses
(wide band gap semiconductors of SiC and III-V nitrides)
RN 409-21-2 HCAPLUS
CN Silicon carbide (SiC) (CA INDEX NAME)

*** STRUCTURE DIAGRAM IS NOT AVAILABLE ***
CC 76-3 (Electric Phenomena)
Section cross-reference(s): 75
ST wide gap silicon carbide semiconductor
IT Crystal growth
Epitaxy
Semiconductor materials
(crystals and thin films and devices of the wide band gap
SiC and III-V nitride semiconductors)
IT Energy level, band structure
(gap, crystals and thin films and devices of the wide
band gap SiC and III-V nitride semiconductors)
IT Semiconductor devices
(heterojunction, crystals and thin films and devices of
the wide band gap SiC and III-V nitride semiconductors)
IT 24304-00-5, Aluminum nitride (AlN) 25617-97-4, Gallium
nitride (GaN) 25617-98-5, Indium nitride (InN)
(crystals and thin films and devices of the wide band gap
SiC and III-V nitride semiconductors)
IT 409-21-2, Silicon carbide (SiC),
uses
(wide band gap semiconductors of SiC and III-V nitrides)

L57 ANSWER 20 OF 49 HCAPLUS COPYRIGHT 2007 ACS on STN
ACCESSION NUMBER: 1972:411163 HCAPLUS Full-text
DOCUMENT NUMBER: 77:11163
ORIGINAL REFERENCE NO.: 77:1871a,1874a
TITLE: Fabrication of silicon carbide
electroluminescent displays
AUTHOR(S): Brander, R. W.
CORPORATE SOURCE: Hirst Res. Cent., Gen. Electr. Co. Ltd., Wembley,
UK
SOURCE: Silicon Carbide, Proc. Int. Conf., 2nd (1969), Meeting Date 1968, S187-S197.
Editor(s): Henisch, Heinz K. Pergamon: New York,
N. Y.
CODEN: 24RJA2
DOCUMENT TYPE: Conference
LANGUAGE: English

ED Entered STN: 12 May 1984
AB SiC p-n-junction electroluminescent devices were prepared by the epitaxial deposition of single-crystal layers from a C-saturated Si solution at 1650°. The thickness of the layer varied with the temperature and the temperature gradient, while the quality of the layer improved with growth rates <0.5 µ/min. P-n junctions were grown by depositing n-type 10-300-Mø-cm compensated doped layers containing N2 and Al or B onto p-type Al-doped

0.1-3.0- μ m Si C substrates. Typical applications described are indicator lamps, film markers, alphanumeric displays, and "magic eye" tuning indicators. Evaporated Ti/Au formed good ohmic contacts at 250° on n-type and nonohmic contacts on p-type SiC. A linear relation occurred between light output and junction current. The color produced varied inversely with temperature, but was still visible at 300-400°. Room-temperature brightness of 100 footlamberts was obtained and with adequate cooling, 1000 footlamberts. No deterioration was observed in light output after 15,000 hr of operation at $\leq 400^\circ$ and 50-200 mA.

IT 409-21-2, uses and miscellaneous
(electroluminescent devices from)
RN 409-21-2 HCAPLUS
CN Silicon carbide (SiC) (CA INDEX NAME)

*** STRUCTURE DIAGRAM IS NOT AVAILABLE ***

CC 71-13 (Electric Phenomena)
Section cross-reference(s): 73
ST silicon carbide electroluminescent display
IT Electroluminescent devices
(from silicon carbide)
IT 409-21-2, uses and miscellaneous
(electroluminescent devices from)

L57 ANSWER 21 OF 49 HCAPLUS COPYRIGHT 2007 ACS on STN

ACCESSION NUMBER: 1969:32747 HCAPLUS Full-text
DOCUMENT NUMBER: 70:32747
ORIGINAL REFERENCE NO.: 70:6141a
TITLE: Semiconductor device, in particular of silicon, a
silicon-germanium alloy or silicon
carbide
INVENTOR(S): Gueckel, Helmut
PATENT ASSIGNEE(S): Siemens A.-G.
SOURCE: Ger., 5 pp.
CODEN: GWXXAW
DOCUMENT TYPE: Patent
LANGUAGE: German
FAMILY ACC. NUM. COUNT: 1
PATENT INFORMATION:

PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
-----	---	-----	-----	-----
DE 1264619	B	19680328	DE 1965-S97677	19650618
			<--	
PRIORITY APPLN. INFO.:			DE 1965-S97677	A 19650618
			<--	

ED Entered STN: 12 May 1984

AB A semiconductor device such as a transistor is produced from Si, a Si-Ge alloy, or SiC by oxidizing the surface of the semiconductor during a 1st and a 2nd exposure to oxidizing conditions and removing the oxide layer which has been formed on a surface area part during the 2nd exposure only. Another partial area separated from the 1st one and equally subjected to the 2nd oxidizing step and not having been covered with oxide layer during the 1st oxidizing step is treated with the oxide removal process until the optical difference between the 2 surface area parts vanishes. As an example, a Si single crystal pellet is covered with an insulating SiO₂ layer. A window is etched into this layer on part of the surface area, and P203 or P205 is diffused there for producing n-type conduction, or B203 for p-type conduction, by applying the resp. doping agent in gas phase on the heated Si crystal to form a base region, whereas the doping agent cannot affect the part of Si protected by the SiO₂ layer. The O liberated during the doping process, the

original doping gas phase being free of O, acts upon the window region in forming there again an SiO₂ layer, without interrupting the reaction of the doping agent with the base region. The 2nd step serves to produce the emitter zone. For this purpose, a smaller window is etched inside the area of the original window under removal of the secondary SiO₂ layer. Through this window, doping material is diffused to reestablish the basic conductivity type of the original crystal, again choosing the doping agent in oxide form being stopped by the SiO₂ layer. The emitter zone is again covered with SiO₂. In order to apply a contact of a lead to the emitter, a 3rd window must be etched into this SiO₂ layer, covering the portions to be masked with photo-lacquer. In order to overcome the difficulty of not being able to obtain very small etched windows by photolithography, an auxiliary large window is etched into the primary SiO₂ layer on another part of the Si crystal surface simultaneously with the 2nd smaller window, the auxiliary window, which is of no critical size, going through the SiO₂ layer to the semiconductor crystal material. It is at such a distance from the base zone that it cannot be disturbed by receiving eventually doping material and can eventually be sectioned away with the underlying semiconductor portion. Etching off SiO₂ is done until the small window and the auxiliary window show no optical thickness differences. Contact is made to the emitter zone by evaporating Al onto the small window and dissolving away the excess area by very diluted NaOH or aqueous Na₂CO₃ or (NH₄)CO₃ solution which do not affect the SiO₂ layer. The correct thickness of the SiO₂ layer is obtained by the observation of the vanishing optical difference between the small and the auxiliary window indicated by reflected light brightness or by interference colors distinct for Si not covered by SiO₂ layer.

IC H01L
CC 71 (Electric Phenomena)
IT Semiconductors, electric
(devices, window formation in silica masks in manufacture of)

=> d 22-36 full

L57 ANSWER 22 OF 49 WPIX COPYRIGHT 2007 THE THOMSON CORP on STN
AN 2006-154239 [16] WPIX Full-text
CR 1995-275475; 1996-371672; 2001-079550; 2001-482550; 2002-138759;
2002-403288; 2002-547203; 2002-722177; 2003-075380; 2003-491810
DNC C2006-051859 [16]
DNN N2006-133280 [16]
TI Making of free-standing III-V nitride single crystal article
by growing single crystal III-V nitride material by vapor
deposition process conducted at elevated growth temperature, and
removing the substrate
DC L03; U11
IN KUECH T F; TISCHLER M A; VAUDO R P
PA (KUECH-I) KUECH T F; (TISC-I) TISCHLER M A; (VAUD-I) VAUDO R P
CYC 1
PI US 20060032432 A1 20060216 (200616)* EN 11[9]
ADT US 20060032432 A1 CIP of US 1994-188469 19940127; US
20060032432 A1 Cont of US 1997-955168 19971021; US
20060032432 A1 Cont of US 2001-929789 20010814; US
20060032432 A1 US 2005-243768 20051005
FDT US 20060032432 A1 CIP of US 5679152 A; US 20060032432 A1 Cont of US
6972051 B
PRAI US 2005-243768 20051005
US 1994-188469 19940127
US 1997-955168 19971021
US 2001-929789 20010814
IPCI C39B0023-00 [I,A]; C30B0023-00 [I,C];

C30B0025-00 [I,A]; C30B0025-00 [I,C];
 C30B0028-00 [I,C]; C30B0028-12 [I,A];
 C30B0028-14 [I,A]

AB US 20060032432 A1 UPAB: 20060308

NOVELTY - A free-standing III-V nitride single crystal article is made by growing single crystal III-V nitride material, on and across a surface of a heterogeneous substrate, by a vapor deposition process conducted at elevated growth temperature; and removing the heterogeneous substrate to yield a free-standing III-V nitride single crystal article having a diameter or corresponding dimension in an x,y plane that greater than or equal to 2.5 cm, and is greater than or equal to 100 microns in thickness.

DETAILED DESCRIPTION - Making of a free-standing III-V nitride single crystal article comprises growing single crystal III-V nitride material, on and across a surface of a heterogeneous substrate having a diameter or corresponding dimension in an x,y plane of the surface that is greater than or equal to 2.5 cm, to a thickness of greater than or equal to 100 microns, by a vapor deposition process conducted at elevated growth temperature. The heterogeneous substrate is removed from the single crystal III-V nitride material grown to the thickness, while the single crystal III-V nitride material is at 300degreesC of the elevated growth temperature and prior to cooling of the single crystal III-V nitride material to more than 300degreesC below the elevated growth temperature, to yield a free-standing III-V nitride single crystal article having a diameter or corresponding dimension in an x,y plane that greater than or equal to 2.5 cm, and is greater than or equal to 100 microns in thickness.

USE - For making of a free-standing III-V nitride single crystal article as a substrate for the fabrication of microelectronic structures to produce microelectronic devices.

ADVANTAGE - The invention can produce large diameter substrates. The substrates are essentially ready for subsequent processing after growth. No orienting, coring, flattening, or sawing is required as in bulk growth. Many substrates can be produced simultaneously. No defects from thermal coefficient of expansion differences are produced. The defect density can be further reduced by using buffer layers such as a strained layer superlattice. Heavily doped back contact layers for ohmic contacts may be produced. Substrates of varying compositions can be easily produced. Substrates with compositional variations can also be easily produced, because the gas phase ratio can be varied during growth. The doping density in the substrates can be easily controlled, again by gas phase composition control. No problems associated with segregation coefficient issues are involved. In addition, the doping in the substrate can be varied, if desired, throughout the thickness of the single crystal MasteriskN substrate being prepared.

DESCRIPTION OF DRAWINGS - The figure is a side elevation view of the silicon/MasteriskN structure, showing the etching action of a silicon etchant on the silicon substrate portion of the structure.

Substrate (20)

III-V nitride single crystal article (22)

Top surface (24)

Single crystal (26)

Layer of silicon-doped n-type MasteriskN (30)

TECH INORGANIC CHEMISTRY - Preferred Method: A microelectronic structure is fabricated on the free-standing III-V nitride single crystal article (22). The heterogeneous substrate (20) is positioned between a growth chamber adapted to carry out the growing, and a removal chamber adapted to carry out the removing. The growing is conducted for sufficient time to grow the single crystal (26) III-V nitride material over edges of the surface of the heterogeneous substrate to enhance sealing between the growth chamber and the removal chamber. The removing comprises chemical action on the heterogeneous substrate using

hydrogen chloride or hydrogen fluoride. The growing is carried out with diffusion of species from the heterogeneous substrate into the III-V nitride material for doping. The removing includes fracturing the substrate from the III-V nitride material by in situ pressure building at elevated temperature in the heterogeneous substrate. The single crystal III-V nitride material is doped during the growing by using at least one dopant species from silicon, germanium, sulfur, selenium, magnesium, zinc, beryllium, vanadium, or iron. A light emitting diode is fabricated on the free-standing III-V nitride single crystal article. The heterogeneous substrate is disposed in a wafer carrier between the growth chamber and the removal chamber. The removing comprises exposure of the heterogeneous substrate to a halogen-containing gas in the removal chamber. The method comprises removing the heterogeneous substrate from the single crystal III-V nitride material grown to the thickness, while the single crystal III-V nitride material is at 100degreesC, preferably 25degreesC of the elevated growth temperature and prior to cooling of the single crystal III-V nitride material to more than 100degreesC, preferably more than 25degreesC below the elevated growth temperature. The removal step uses plasma or laser radiation. Preferred Component: The heterogeneous substrate comprises a substrate from silicon-on-insulator substrates, compliant substrates, substrates containing implant species, or twist-bonded substrates. The heterogeneous substrate contains implanted hydrogen. Preferred Material: The III-V nitride is gallium nitride. The heterogeneous substrate comprises material from silicon, silicon carbide, gallium arsenide, sapphire, magnesium aluminate, magnesium oxide, scandium aluminum magnesiate, lithium aluminate, lithium gallate, zinc oxide, graphite, glass, metal nitride, or silicon dioxide. The heterogeneous substrate comprises silicon, and the III-V nitride single crystal article is silicon-doped.

Preferred Condition: The elevated growth temperature comprises is at 800-1300degreesC. The vapor deposition process is conducted at subatmospheric pressure at 1 mTorr to 1 atm, or 1-1000 mTorr. Preferred Dimension: The free-standing III-V nitride single crystal article has a diameter or corresponding dimension in an x,y plane that is greater than 10 inches. The free-standing III-V nitride single crystal article has a diameter or corresponding dimension in an x,y plane that is 3-18 inches.

FS CPI; EPI

MC CPI; L04-A02A; L04-C01

EPI: U11-C01B; U11-C01J1; U11-C01J3A

L57 ANSWER 23 OF 49 WPIX COPYRIGHT 2007 THE THOMSON CORP on STN

AN 2005-254036 [26] WPIX Full-text

DNC C2005-080495 [26]

DNN N2005-209123 [26]

TI Overgrowing elongated nanosize element with epitaxial layer useful in e.g. integrated circuits involves encapsulating the nanosize element with epitaxially grown layer followed by lithographic preparation of components

DC E19; L03; U11; U12

IN HAUPTMANN J; HAUPTMANN J R; JENSEN A; LINDELOF P; LINDELOF P E G; NYGAARD J; SADOWSKI J; LINDELOF P E G H

PA (UYKO-N) UNIV KOBENHAVNS; (HAUP-I) HAUPTMANN J R; (JENS-I) JENSEN A; (LIND-I) LINDELOF P E G H; (NYGA-I) NYGAARD J; (SADO-I) SADOWSKI J

CYC 107

PI WO 2005027201 A1 20050324 (200526)* EN 31[6] H01L021-00
 EP 1678741 A1 20060712 (200648) EN
 CN 1868030 A 20061122 (200720) ZH
 US 20070157873 A1 20070712 (200748) EN

ADT WO 2005027201 A1 WO 2004-DK603 20040910; CN 1868030 A CN 2004-80029859
 20040910; EP 1678741 A1 EP 2004-762823 20040910; EP 1678741 A1 WO
 2004-DK603 20040910; US 20070157873 A1 WO 2004-DK603 20040910; US
 20070157873 A1 US 2006-571520 20061222

FDT EP 1678741 A1 Based on WO 2005027201 A

PRAI DK 2003-1325 26630912

IPCI C30B0025-02 [I,A]; C30B0025-16 [I,A];
 C30B0033-00 [I,A]; H01L0021-00 [I,C]; C30B0013-00 [I,A];
 [I,A]; C30B0013-00 [I,C]; C30B0023-00 [I,A];
 C30B0023-00 [I,C]; C30B0025-00 [I,A];
 C30B0025-00 [I,C]; C30B0028-00 [I,C];
 C30B0028-12 [I,A]; H01L0021-00 [I,A]

IPCR C30B0025-02 [I,A]; C30B0025-02 [I,C];
 C30B0025-18 [I,A]; C30B0025-18 [I,C]

AB WO 2005027201 A1 UPAB: 20060122

NOVELTY - Overgrowing elongated nanosize elements (E1) with at least one epitaxial layer involves: providing (E1) on a substrate or on at least top layer of the substrate having surface supporting epitaxial growth of epitaxial layer; epitaxially overgrowing the substrate and (E1) with epitaxial layer and thereby at least partly encapsulating (E1) into the epitaxially grown layer; and preparing at least one component prepared by lithography in the layer.

USE - For overgrowing elongated nanosize elements with at least one epitaxial layer e.g. nanowire or nanowhisker that acts as heat removing element and heat conducting layer; and useful in the formation of monolithic integrated circuit system, an electronic component, electronic device e.g. integrated circuit, optical device and nano-electro mechanical system (claimed), light emitting devices, electron emitting devices, spin-tronic devices and sensor devices.

ADVANTAGE - The device prepared by the method exhibits superior properties as compared to the conventional electronic device. The method provides electronic components or devices of the integrated circuit type with improved performance and without requiring extensive cooling during operation. The device has excellent thermal conductivity. The epitaxially grown material controls atomic/molecular compositions of the devices with a very high precision and accurately controls the doping profiles.

TECH ELECTRONICS - Preferred Method: The epitaxial layer and the at least top layer of the substrate, is grown by molecular beam epitaxy, or by chemical vapor deposition process or by liquid phase deposition process.

The lattice constants of at least the top layer and the epitaxial layer are matched by providing a barrier between the substrate and the epitaxial layer.

The substrate or at least top layer of the substrate is covered by, a first protection layer (preferably by amorphous arsenic, sulfur, hydrogen or oxygen layer, especially As).

The method further involves annealing prior to the step of epitaxially overgrowing the substrate and (E1). (E1) is provided on the substrate by liquid deposition, and is grown without the presence of a catalyst e.g. by annealing silicon carbide.

The method involves providing islands or particles of catalytic material to the substrate and growing (E1) on the substrate from the catalytic material. (E1) Are manipulated prior to the step of epitaxially overgrowing the substrate and (E1), in order to obtain a specific orientation or positioning of

the carbon nanotube on the substrate.

The metallic contact pads are formed and connected to the components by lithography and lift-off.

Preferred Components: The epitaxial layer is semiconducting, metallic or magnetic, and has a thickness 5 nm - 5 micrometers (preferably 5 - 500, especially 5 - 100, particularly 20 - 30) nm.

The at least one component is defined by e-beam, X-ray, ion-beam, UV-lithography, AFM-lithography, nano-imprint lithography or by shadow mask technique.

The substrate or at least top layer of the substrate

is semiconducting; is doped to be n-

type or p-type; and is mono-

crystalline material. At least one of the substrate

and the top layer comprises alignment marks and is covered with a barrier.

The barrier comprises a stack of layers, where at least one of the layers comprises a material corresponding to the material of the substrate or the material of the top layer.

The barrier forms a super-lattice (preferably super-lattice of AlAs and GaAs layers).

The layers in the stack of layers have thickness of 1 - 5 (preferably 1 - 3, especially 2 - 4, particularly 2) nm.

The stack of layers has thickness of 5 - 1000 (preferably 25 - 750, especially 50 - 500, particularly 100) nm.

The epitaxial layer is covered by, a second protecting layer having thickness of 2 - 10 nm. (E1) Is insulating, semiconducting or metallic.

INORGANIC CHEMISTRY - Preferred Components: (E1) Is made of any one of carbon, Si, SiC, B, BN, Pt, SiGe, Ge, Ag, Pb, ZnO, GaAs, GaP, InAs, InP, In, Co, Fe, CdS, CdSe, SnO₂, Se, Te, Si₃N₄, or MgB₂ (preferably a carbon nanotube).

The carbon nanotubes are single-walled or multi-walled.

The carbon nanotubes are grown using laser ablation, the arc method, chemical vapor deposition (CVD), or high pressure CO CVD and subsequently provided to the surface supporting epitaxial growth.

METALLURGY - Preferred Components: The epitaxial layer is GaMnAs, GaAlAs, GaAs, SiGe, GaInAs, InP, Si, SiGe, GaN, GaAlN, Au, Ag, Al, Cu, metallic alloys e.g. MnGa and single double Heusler alloys (CoMnGa, Co₂MnGa), or half-metallic ferromagnetics (preferably GaMnAs).

The substrate comprises GaAs, Si, SiN, SiC, glass,

or metal oxides such as Al₂O₃ (preferably GaAs).

ORGANIC CHEMISTRY - Preferred Components: The epitaxial layer is organic semiconductors e.g. 3,4,9,10-perylenetetra-carboxylic acid (PTCA), 3,4,9,10-dianhydride of PTCA, or 4,9,10-perylenetetra-carboxylic-dianhydride (PTCDA) dye molecules.

FS CPl; EPl

MC CPl: E05-U03; E06-D18; E09-B; E31-G; E31-H05; E31-K07; E31-L; E31-N03D; E31-N04D; E31-P06; E31-Q01; E31-Q03; E34-B03; E35; L04-C01

EPl: U11-C01J1; U12-B03F2

L57 ANSWER 24 OF 49 WPIX COPYRIGHT 2007 THE THOMSON CORP on STN

AN 2005-475532 [48] WPIX Full-text

CR 2004-142045; 2004-736766; 2006-372405

DNC C2005-144952 [48]

DNN N2005-386796 [48]

TI Silicon carbide wafer for, e.g. field effect transistors, comprises single polytype single crystal

and has specified diameter, resistivity, and combined concentration of shallow level dopants:

DC L03; U11
 IN BRADY M; HOBGOOD H M; JENNY J R; LEONARD R T; MALTA D P; MUELLER S G; POWELL A; TSVETKOV V F; JENNY J
 PA (BRAD-I) BRADY M; (HOBG-I) HOBGOOD H M; (JENN-I) JENNY J R; (LEON-I) LEONARD R T; (MALT-I) MALTA D P; (MUEL-I) MUELLER S G; (POWE-I) POWELL A; (TSVE-I) TSVETKOV V F; (CREE-N) CREE INC
 CYC 108
 PI US 20050126471 A1 20050616 (200548)* EN 29[12]
 WO 2006011976 A1 20060202 (200614) EN
 EP 1784528 A1 20070516 (200734) EN
 KR 2007028589 A 20070312 (200755) KO
 CN 1973064 A 20070530 (200763) ZH
 ADT US 20050126471 A1 CIP of US 2002-64232 20020624; US 20050126471 A1 US 2004-876963 20040625; EP 1784528 A1 EP 2005-760208 20050614; WO 2006011976 A1 WO 2005-US20718 20050614; EP 1784528 A1 WO 2005-US20718 20050614; KR 2007028589 A WO 2005-US20718 20050614; KR 2007028589 A KR 2007-701899 20070125; CN 1973064 A CN 2005-80021074 20050614
 FDT US 20050126471 A1 CIP of US 6814801 B; EP 1784528 A1 Based on WO 2006011976 A; KR 2007028589 A Based on WO 2006011976 A
 PRAI US 2004-876963 20040625
 US 2002-64232 20020624
 IC ICM C30B023-00
 ICS C30B025-00; C30B028-12; C30B023-14
 IPCI C30B0023-00 [I,A]; C30B0023-00 [I,C]; C30B0029-10 [I,C]; C30B0029-36 [I,A]; C30B0033-00 [I,A]; C30B0033-00 [I,C]; C30B0023-00 [I,A]; C30B0023-00 [I,C]; C30B0029-10 [I,C]; C30B0029-36 [I,A]; C30B0033-00 [I,A]; C30B0033-00 [I,C]
 IPCR C30B0023-00 [I,A]; C30B0023-00 [I,C]; C30B0029-10 [I,C]; C30B0029-36 [I,A]; C30B0033-00 [I,A]; C30B0033-00 [I,C]
 AB US 20050126471 A1 UPAB: 20051223

NOVELTY - Silicon carbide wafer comprises single polytype single crystal. The wafer has a diameter greater than 3-less than 5 inches, resistivity greater than 10000 Omega-cm, micro pipe density less than 200/cm², and combined concentration of shallow level dopants less than 5x10¹⁶/cm³.

DETAILED DESCRIPTION - An INDEPENDENT CLAIM is included for a single crystal of silicon carbide grown by deposition of vapor species containing silicon and carbon on seed crystal growth surface. The crystal has diameter of greater than 3 inches and resistivity greater than 10000Omega-cm.

USE - For use in making field effect transistors, metal oxide semiconductor field effect transistor (MOSFET), junction field effect transistor, metal semiconductor field effect transistor, heterostructure field effect transistor, high electron mobility transistor, extended drain MOSFET, or lateral diffused metal oxide semiconductor transistors (claimed). It can also be used for high frequency power devices, high power devices, high temperature devices, optoelectronic devices and Group III nitride desorption.

ADVANTAGE - Allows identification and addressing source of defects at the seed, thus providing improvement in the quality of single crystal silicon carbide bulk crystals and reduces the defect density. It enhances the production of wafer. It reduces or eliminates the use of vanadium to produce semi-insulating character in the silicon carbide.

DESCRIPTION OF DRAWINGS - The figure shows a schematic diagram illustrating temperature ranges.

Temperature line (10,12,14-17)

Temperature range (11,13)

TECH ELECTRONICS - Preferred Properties: The wafer has diameter of 100 mm, resistivity of greater than or equal to 50 000 $\Omega\text{-cm}$ at room temperature or 10 000 $\Omega\text{-cm}$, and micro pipe density less than 200/cm², concentration of point defects of less than or equal to $5 \times 10^{17} \text{ cm}^{-3}$, and less than 100, preferably less than 5 micro pipes per cm². The wafer is an on- or off-axis silicon carbide wafer. The off-axis orientation is 8degrees, 4degrees, or 3.5degrees. Preferred Components: The polytype is 3C, 4H, 6H, or 15R polytypes of silicon carbide. The wafer includes epitaxial layer. The epitaxial layer is silicon carbide or Group III nitrides. The wafer contains nitrogen (less than $2 \times 10^{15} \text{ cm}^{-3}$), and vanadium ($1 \times 10^{14} \text{ cm}^{-3}$). The wafer preferably comprises donor dopants, acceptor dopants, and intrinsic point defects in silicon carbide single crystal. The number of dopants of first conductivity type is greater than the number of dopants of second conductivity type. The number of intrinsic point defects in silicon carbide crystal that acts to compensate the predominating first type dopant is greater than the numerical difference where the first type of dopant predominates over the second type of dopant. The concentration of the transistor mechanism is less than $1 \times 10^{16} \text{ cm}^{-3}$. The wafer comprises electrically active nitrogen, electrically active point defects acting as acceptor, and acceptor mechanism with electronic energy level of 0.3-1.4 eV relative to the valence band of mono-crystalline silicon carbide. The acceptor mechanism is present in an amount compensating the nitrogen and pins the Fermi level of silicon carbide substrate to the electronic energy level of the acceptor mechanism(s). The combined amount of acceptor mechanism and point defects is greater than the amount of the electrically active nitrogen and pins the Fermi level of the silicon carbide single crystal to the electronic energy level of acceptor mechanism(s). The wafer can also comprise non-intentionally introduced nitrogen, scandium, and boron. The concentration of nitrogen is greater than the concentration of scandium. The concentration of boron is equal to the sum of concentration of boron and scandium to overcompensate the nitrogen, and pin the Fermi level of silicon carbide to level of scandium. The combined concentration of shallow level dopants is less than $5 \times 10^{26} \text{ cm}^{-3}$. Preferred Methods: The single crystal of unintentionally doped silicon carbide can also be grown by sublimation of silicon carbide source powder to generated vapor species containing silicon and carbon without intentional introduction of P or N-type dopant atoms.

FS CPI; EPI
MC CPI: L04-A01B; L04-B01; L04-C01; L04-E01A
EPI: U11-B03C

L57 ANSWER 25 OF 49 WPIX COPYRIGHT 2007 THE THOMSON CORP on STN
AN 2005-039515 [04] WPIX Full-text
DNC C2005-013139 [04]
DNN N2005-034551 [04]

TI Producing epitaxial layer of gallium nitride involves disposing mask layer and selective growing layer on two or more layers alternatively, and placing subsequent masks exactly parallel on top of each other

DC L03; U11
 IN BEAUMONT B; FAURIE J; GIBART P; FAURIE J P
 PA (LUMI-N) LUMILOG; (BEAU-I) BEAUMONT B; (FAUR-I) FAURIE J; (GIBA-I) GIBART P
 CYC 107
 PI WO 2004105108 A2 20041202 (200504)* EN 34[11]
 EP 1625612 A2 20060215 (200613) EN
 KR 2006017804 A 20060227 (200660) KO
 CN 1791966 A 20060621 (200672) ZH
 US 20060266281 A1 20061130 (200680) EN
 JP 2007502546 W 20070208 (200713) JA 20
 ADT WO 2004105108 A2 WO 2004-IB1914 20040518; CN 1791966 A CN
 2004-80013908 20040518; EP 1625612 A2 EP 2004-733606 20040518; EP
 1625612 A2 WO 2004-IB1914 20040518; KR 2006017804 A WO 2004-IB1914
 20040518; US 20060266281 A1 WO 2004-IB1914 20040518; US 20060266281 A1
 US 2005-556316 20051109; KR 2006017804 A KR 2005-722253 20051121; JP
 2007502546 W WO 2004-IB1914 20040518; JP 2007502546 W JP 2006-530713
 20040518
 FDT EP 1625612 A2 Based on WO 2004105108 A; KR 2006017804 A Based
 on WO 2004105108 A; JP 2007502546 W Based on WO 2004105108 A
 PRAI US 2003-473829F 26838521
 US 2005-556316 20051109
 IPCI C30B0023-00 [I,A]; C30B0023-00 [I,C];
 C30B0025-00 [I,A]; C30B0025-00 [I,C];
 C30B0029-00 [I,C]; C30B0028-12 [I,A];
 C30B0029-14 [I,A]; C30B0029-10 [I,C];
 C30B0029-40 [I,A]; H01L0021-02 [I,C]; H01L0021-02 [I,C];
 H01L0021-20 [I,A]; H01L0021-20 [I,A]; H01L0021-32 [I,A]; H01S0005-00
 [I,A]
 IPCR C30B0025-02 [I,A]; C30B0025-02 [I,C];
 C30B0025-04 [I,A]; C30B0025-04 [I,C]; H01L0021-02
 [I,C]; H01L0021-20 [I,A]; H01L0021-205 [I,A]; H01S0005-00 [N,C];
 H01S0005-02 [N,A]
 AB WO 2004105108 A2 UPAB; 20060121
 NOVELTY - An epitaxial layer of gallium nitride is produced by forming a mask
 with openings on a substrate, selectively growing a layer using the mask
 layer, disposing the mask layer and a selective growing layer on two or more
 layers alternatively, and placing subsequent masks exactly parallel on top of
 each other.
 DETAILED DESCRIPTION - Production of an epitaxial layer of gallium
 nitride involves:
 (a) depositing a gallium nitride layer on a substrate ,
 (b) depositing a first mask with first openings forming patterns,
 (c) first regrowth of a gallium nitride layer on the mask under
 epitaxial conditions,
 (d) second regrowth of gallium nitride with a doping agent as an
 enhancer of lateral growth with respect to the vertical growth to induce the
 deposition of gallium nitride features and anisotropic and lateral growth of
 the features,
 (e) depositing a second mask with second openings forming the same
 patterns as the first openings providing that the pitch of the pattern of the
 first opening is exactly identical or twice the pitch of the second openings,
 (f) third regrowth of a gallium nitride layer on the second mask under
 epitaxial conditions, and
 (g) a fourth regrowth of gallium nitride with a doping agent as an
 enhancer of lateral growth with respect to the vertical growth to induce the
 deposition of gallium nitride features and anisotropic and lateral growth of
 the features.

INDEPENDENT CLAIMS are also included for:

(i) thick free standing gallium nitride obtained by thickening, by halide vapor phase epitaxy, or close space vapor phase transport the gallium nitride epitaxial layer produced by the inventive method; and

(ii) optoelectronic component, especially a diode laser, provided with an epitaxial layer of gallium nitride layer produced by the inventive method.

USE - For producing an epitaxial layer of gallium nitride (claimed) for growth of devices, e.g. blue-violet laser diodes.

ADVANTAGE - Reduces dislocation density over the entire surface.

TECH ELECTRONICS - Preferred Process: The temperature is raised during the second and fourth regrowths to enhance the lateral growth. The ratio of the partial pressure of ammonia over than gallium source is raised during the second and fourth regrowths to enhance the lateral growth. The pressure is lowered during the second and fourth regrowths to enhance the lateral growth. Each opening pattern takes form in pattern elements arranged in one direction in a plane almost parallel to the surface of the substrate. The pitch of pattern elements of one pattern and the pitch of pattern elements of another patterns are different from each other, but the patterns remain parallel to each other. The second regrowth of gallium nitride is not continued until coalescence of the features to form voids into the obtained epitaxial layer of gallium nitride. The upper part of the obtained epitaxial layer of gallium nitride is spontaneously separated thanks to the presence of voids. The vapor phase epitaxial deposition conditions involve the use of a carrier gas preferably comprising nitrogen/hydrogen mixture. The second and fourth regrowths are carried out by metal organic vapor phase epitaxy, halide vapor phase epitaxy, and/or close space vapor transport. The gallium nitride is deposited on the substrate by depositing a silicon nitride layer functioning as a nanomask on the substrate, depositing a buffer layer of gallium nitride, ramping the temperature up to the final growth temperature to make islands develop, and depositing a gallium nitride layer under epitaxial conditions. Preferred Component: The pattern elements are in the form of stripes. The openings are punctual openings. The top gallium nitride is doped n or p-type. Preferred Composition: The exposed proportion of substrate or of gallium nitride with respect to the total area of the substrate is 5-80 %. Preferred Property: The stripes have a width of less than 10 microns. The gallium nitride layer has a thickness of 1-1000 (10-1000) microns.

INORGANIC CHEMISTRY - Preferred Component: The substrate is zinc oxide, 6H-SiC, 4H-SiC, 3C-SiC, silicon, gallium arsenide, lithium gallium oxide, lithium aluminum oxide, zinc boride, hafnium boride, gallium arsenide, aluminum nitride, gallium nitride, or magnesium aluminum oxide (MgAl₂O₄). The dielectric layer is a layer of SixNy type. The dopant used in the second and fourth regrowths is magnesium, antimony, or bismuth.

ORGANIC CHEMISTRY - Preferred Component: The substrate is zinc oxide, 6H-SiC, 4H-SiC, 3C-SiC, silicon, gallium arsenide, lithium gallium oxide, lithium aluminum oxide, zinc boride, hafnium boride, gallium arsenide, aluminum nitride, gallium nitride, or magnesium aluminum oxide (MgAl₂O₄). The dielectric layer is a layer of SixNy type. The dopant used in the second and fourth regrowths is magnesium, antimony, or bismuth.

FS CPI; EPI

MC CPI: L04-A02A1A; L04-C01; L04-C06A

EPI: U11-C01J1; U11-C01J3A

L57 ANSWER 26 OF 49 WPIX COPYRIGHT 2007 THE THOMSON CORP on STN
 AN 2005-038303 [04] WPIX Full-text
 CR 2004-280063; 2004-727612
 DNC C2005-012636 [04]
 DNN N2005-033560 [04]
 TI Light emitting device for laser device, has semiconductor active region and gallium nitride substrate, in which the substrate is removable from the active region and has specified optical absorption coefficient
 DC L03; U12
 IN CAO X; DEVELYN M P; EVERS N A; LEBOEUF S F; ZHANG A; CAO X A; D'EVELYN M P; ZHANG A P
 PA (GENE-C) GENERAL ELECTRIC CO
 CYC 1
 PI US 20040245535 A1 20041209 (200504)* EN 20[8]
 US 7053413 B2 20060530 (200636) EN
 ADT US 20040245535 A1 Div Ex US 2000-694690 20001023; US 20040245535 A1 CIP of US 2003-440574 20030519; US 20040245535 A1 US 2004-831865 20040426
 FRAI US 2004-831865 20040426
 US 2000-694690 20001023
 US 2003-440574 20030519
 IPCI H01L0027-15 [I,A]; H01L0027-15 [I,C]
 IPCR H01L0033-00 [I,A]; H01L0033-00 [I,C]
 AB US 20040245535 A1 UPAB: 20050707
 NOVELTY - Light emitting device (LED) comprises a light emitting semiconductor active region disposed on a single crystal substrate of gallium nitride. Each of the active region and the substrate has a dislocation density of less than 1×10^4 per cm^2 and is free of crystallographic tilt boundaries. The substrate is removable from the active region and has an optical absorption coefficient of below 100/cm at wavelengths of 700-465 nm.
 DETAILED DESCRIPTION - INDEPENDENT CLAIMS are also included for:
 (1) a method for preparing the above LED comprising disposing a group m semiconductor active layer on the substrate (4); and
 (2) a laser device comprising homo epitaxial laser diode(s).
 The homo epitaxial laser diode comprises:
 (A) an n-electrode;
 (B) removable single crystal n-gallium nitride (n-GaN) substrate;
 (C) an aluminum indium gallium nitride-containing compound (AlcIndGal-c-dN/AleInfGal-e-fN) multiple quantum well layer (22), which is free of crystallographic tilt boundaries;
 (D) cladding layer(s) (10) comprising p-GaN or p-AlgInhGal-g-hN and having a dislocation density of less than 1×10^4 per cm^2 and is free of crystallographic tilt boundaries;
 (E) a p-type electrode; and
 (F) a reflective surface on edge(s) of the homo epitaxial laser diode.
 The reflective surface comprises a facet formed by cleaving along a (1010) crystallographic plane of the substrate, the multiple quantum well layer, and the cladding layer(s). The band gap of the multiple quantum well active layer is less than that of the cladding layers.
 c-h, (c+d), (e+f), (g+h)=0-1
 USE - The LED, e.g. light emitting diode or laser diode is used for laser device (claimed).
 ADVANTAGE - The inventive LED has a high quality GaN substrate, and free of tilt boundaries thus improving efficiency, yield, and performance of the device.
 DESCRIPTION OF DRAWINGS - The figure illustrates the structure of homo epitaxial laser diode device.
 Substrate (4)
 Cladding layer (10)

P-type contact layer (12)
 Contacts (14, 16)
 N-contact layer (20)
 Multiple quantum well layer (22)

TECH IMAGING AND COMMUNICATION - Preferred Properties: The dislocation density is less than 1×10^3 (preferably less than 100) per cm^2 . The transparent substrate has an absorption coefficient of below $5/\text{cm}$ at $700\text{--}465\text{ nm}$ wavelengths. The substrate has a carrier mobility of above $100\text{ cm}^2/\text{V}\cdot\text{s}$, strain of below 0.005% , electrical resistivity of below 100 (preferably below 1) $\Omega\cdot\text{cm}$, thickness of $0.05\text{--}5\text{ }\mu\text{m}$, characteristic absorption peak at $3175/\text{cm}$ with absorbance per unit thickness of greater than $0.01/\text{cm}$, and carrier concentration of below $1 \times 10^{19}/\text{cm}^3$. The LED has a lateral surface area of greater than or equal to 1×10^4 (preferably 9×10^4) μm^2 and is dislocation free. Preferred Parameter: Each layer of multiple quantum well has a thickness of $0.5\text{--}50\text{ nm}$. The semiconductor active region comprises a single doped layer having a thickness of $50\text{--}500\text{ nm}$, or a single undoped layer having a thickness of $1\text{--}10\text{ nm}$. A ratio of the sum of band-edge emission intensity, near-band edge emission intensity, and deep-level emission intensity from the substrate to the emission intensity from the active layer at wavelength of shorter than 360 nm is less than 1 (preferably less than 0.01)%. Preferred Component: The substrate has a wurtzite structure. The semiconductor active region emits light in the ultraviolet to red range of the electromagnetic spectrum. The multiple quantum well comprises $2\text{--}50$ alternating layers. Two cladding layers have larger gap than the active layer. The LED includes additional cladding layers disposed between the semiconductor active region and the substrate, a p-type contact layer (12) disposed on the first cladding layer, a p-type electrode in electrical contact with the p-type contact layer, an n-type electrode in contact with the substrate and/or an n-contact layer (20) disposed on the substrate, luminescent and/or dopant producing luminescent light having a wavelength (preferably $300\text{--}1000\text{ nm}$) different from the wavelength of the light produced by the active region. Preferred Method: The substrate has been prepared from a boule grown in a supercritical solvent at above 550°C and above 5 kbar . The light emitting semiconductor active region is disposed directly on the substrate, preferably on $(11\bar{2}0)$ crystallographic face of the substrate. The semiconductive active layer is grown on the single crystal substrate using a patterned mask having a dielectric layer or a chemically inert layer. The first cladding layer is disposed on a side of the semiconductor active region opposite to the substrate. The second cladding layer is disposed between the semiconductor active region and the substrate. The luminescent and/or dopant is disposed on substrate surface or within the substrate, which is removed from the active region. The active layer is disposed by metal organic vapor phase epitaxy, or molecular beam epitaxy. The substrate is annealed at greater than 300°C . The method includes depositing electrical contacts (14, 16) on at least two of the substrate, the p-contact layer, and the n-contact layer. The method includes forming reflective surfaces along opposing edges of the structure to form a laser diode, depositing a distributed Bragg reflector layer on each facet. A short dimension is parallel to a $(10\bar{1}0)$ crystallographic plane of the substrate.

. The reflective faces are formed by cleaving the substrate.
 INORGANIC CHEMISTRY - Preferred Material: The light emitting semiconductor active region is of formula $\text{Al}_w\text{In}_x\text{Ga}_{1-w-x}\text{N}$. The dielectric layer comprises silicon dioxide (SiO_2), silicon nitrides (Si_3N_4), Si, silicon carbide (SiC), zinc oxide (ZnO), titanium oxide (TiO_2), titanium nitride (TiN), tantalum oxides (TaO_x), and/or tantalum nitride (TaN). The first cladding layer may comprise $\text{Al}_y\text{In}_z\text{Ga}_{1-y-z}\text{N}$. The second cladding layer may comprise GaN or $\text{Al}_u\text{In}_v\text{Ga}_{1-u-v}\text{N}$. Each additional cladding layer comprises $\text{Al}_u\text{In}_v\text{Ga}_{1-u-v}\text{N}$. The p-type contact layer comprises p-GaN. The p-type electrode comprises nickel (Ni) and gold (Au). The n-type electrode comprises titanium and aluminum. The luminescent material and/or dopant comprise titanium (Ti), vanadium, chromium (Cr), manganese, iron, cobalt, and/or rare earth metal. The electrical contacts are Ni/Au, Ti/Al, palladium (Pd), platinum (Pt), Au, silver (Ag), copper (Cu), Al, tin (Sn), In, Cr, Ti, scandium (Sc), zirconium (Zr), molybdenum (Mo), Ta, tungsten (W), Ni, hafnium (Hf), a rare earth metal, indium oxide (In_2O_3), tin oxide (SnO_2), and/or zinc oxide (ZnO).

w, x, (w+x)=0-1 (preferably 0.05-0.5);

y, z, (y+z)=0-1;

u, v, (u+v)=0-1.

Preferred Composition: The substrate has a fluorine concentration of greater than 0.04 ppm

ORGANIC CHEMISTRY - Preferred Material: The light emitting semiconductor active region is of formula $\text{Al}_w\text{In}_x\text{Ga}_{1-w-x}\text{N}$. The dielectric layer comprises silicon dioxide (SiO_2), silicon nitrides (Si_3N_4), Si, silicon carbide (SiC), zinc oxide (ZnO), titanium oxide (TiO_2), titanium nitride (TiN), tantalum oxides (TaO_x), and/or tantalum nitride (TaN). The first cladding layer may comprise $\text{Al}_y\text{In}_z\text{Ga}_{1-y-z}\text{N}$. The second cladding layer may comprise GaN or $\text{Al}_u\text{In}_v\text{Ga}_{1-u-v}\text{N}$. Each additional cladding layer comprises $\text{Al}_u\text{In}_v\text{Ga}_{1-u-v}\text{N}$. The p-type contact layer comprises p-GaN. The p-type electrode comprises nickel (Ni) and gold (Au). The n-type electrode comprises titanium and aluminum. The luminescent material and/or dopant comprise titanium (Ti), vanadium, chromium (Cr), manganese, iron, cobalt, and/or rare earth metal. The electrical contacts are Ni/Au, Ti/Al, palladium (Pd), platinum (Pt), Au, silver (Ag), copper (Cu), Al, tin (Sn), In, Cr, Ti, scandium (Sc), zirconium (Zr), molybdenum (Mo), Ta, tungsten (W), Ni, hafnium (Hf), a rare earth metal, indium oxide (In_2O_3), tin oxide (SnO_2), and/or zinc oxide (ZnO).

w, x, (w+x)=0-1 (preferably 0.05-0.5);

y, z, (y+z)=0-1;

u, v, (u+v)=0-1.

Preferred Composition: The substrate has a fluorine concentration of greater than 0.04 ppm

FS CPI; EPI

MC CPI: L04-A02A1A; L04-E03; L04-E03B

EPI: U12-A01B2

L57 ANSWER 27 OF 49 WPIX COPYRIGHT 2007 THE THOMSON CORP on STN

AN 2004-821300 [81] WPIX Full-text

CR 2004-813586; 2004-813591; 2004-832962; 2007-467595

DNC C2004-285442 [81]

DNN N2004-648449 [81]

TI Single crystal zinc oxide substrate for use in electrically excited devices, e.g. light emitting devices, has thin

layer of single crystal zinc oxide having crystal lattice which permits crystal growth of crystal compatible with zinc oxide

DC L03; P73; U11; U12

IN BURGNER R H; FELIX R L; RENLUND G M

PA (BURG-I) BURGNER R H; (FELI-I) FELIX R L; (RENL-I) RENLUND G M

CYC 106

PI US 20040234823 A1 20041125 (200481)* EN 17[8]

WO 2004104274 A2 20041202 (200481) EN

US 7172813 B2 20070206 (200713) EN

ADT US 20040234823 A1 Provisional US 2003-471916P 20030520; US

20040234823 A1 Provisional US 2003-488677P 20030718; US

20040234823 A1 Provisional US 2004-560427P 20040408; US 20040234823 A1

US 2004-849332 20040519; WO 2004104274 A2 WO 2004-US15881 20040520

PRAI US 2004-849332 20040519

US 2003-471916P 20030520

US 2003-488677P 20030718

US 2004-560427P 20040408

IPCI B32B0009-04 [I,A]; B32B0009-04 [I,C]

IPCR B32B0013-00 [I,C]; B32B0013-04 [I,A]; B32B0019-00 [I,A]; B32B0019-00

[I,C]; B32B0009-00 [I,A]; B32B0009-00 [I,C]; B32B0009-04 [I,A];

B32B0009-04 [I,C]; C30B [I,S]; H01L0021-02 [I,C];

H01L0021-20 [N,A]; H01L0021-363 [I,A]; H01L0021-365 [I,A];

H01L0021-368 [I,A]

AB US 20040234823 A1 UPAB: 20060122

NOVELTY - A single crystal zinc oxide substrate comprises: an amorphous self supporting substrate surface; and a thin layer of single crystal zinc oxide deposited on the substrate surface by a chemical deposition process. The thin layer of zinc oxide has a crystal lattice which permits the crystal growth of a crystal compatible with zinc oxide.

USE - For use in electrically excited devices such as light emitting devices (LEDs), laser diodes (LDs), field effect transistors (FETs), and photodetectors operating in UV and at blue wavelengths of visible spectrum.

ADVANTAGE - The substrate can be produced in efficient and economical way. It is a single crystal with a lattice that closely matches the crystal growth.

DESCRIPTION OF DRAWINGS - The figure is a graph of the X-ray diffraction pattern generated by a zinc oxide thin film showing single crystal (002) plane.

TECH INORGANIC CHEMISTRY - Preferred Component: The single crystal

zinc oxide is oriented in the (002) plane. The compatible

crystal has a lattice parameter of 5% of a corresponding

lattice parameter of the zinc oxide. The compatible crystal

comprises epitaxial calcium nitride (CaN). The compatible

crystal comprises p-type or n-

type zinc oxide. The n-type zinc oxide

contains an n-type dopant from ions of

aluminum, gallium, boron, hydrogen, ytterbium and other rare

earth elements, yttrium, and/or scandium.

Preferred Material: The compatible crystal is

aluminum nitride, silicon carbide, or CaN.

The substrate surface is fused silica (SiO₂). The

substrate is an amorphous SiO₂ coating on a silicon

wafer. The inert sputtering gas is argon, krypton, xenon,

neon, or helium. The thin layer of single crystal zinc oxide

comprises n-type zinc oxide. The substrate

further comprises a thin layer of single crystal p

-type zinc oxide deposited on the n-type

zinc oxide.

Preferred Method: The chemical deposition process is radio frequency

(RF) sputtering, chemical vapor deposition (CVD), metal organic CVD, spin coating, electrophoresis, or hydrothermal growth processes. The chemical deposition process comprises RF sputtering using an RF sputtering system comprising a zinc metal target, a substrate surface, and a plasma comprising oxygen and an inert sputtering gas, where the RF sputtering system is operated at conditions which produce the thin layer of single crystal zinc oxide on the substrate surface.

Preferred Parameter: The thin layer of zinc oxide has a thickness of less than 5 microns. The sputtering system was operated at a power of 20-150 (preferably 90-100) watts, and RF frequency of 13.56 MHz at 300-550 (preferably 350-450)degreesC for 1-40 (preferably 1-10) minutes.

ORGANIC CHEMISTRY - Preferred Component: The single crystal zinc oxide is oriented in the (002) plane. The compatible crystal has a lattice parameter of 5% of a corresponding lattice parameter of the zinc oxide. The compatible crystal comprises epitaxial calcium nitride (CaN). The compatible crystal comprises p-type or n-type zinc oxide. The n-type zinc oxide contains an n-type dopant from ions of aluminum, gallium, boron, hydrogen, ytterbium and other rare earth elements, yttrium, and/or scandium.

Preferred Material: The compatible crystal is aluminum nitride, silicon carbide, or CaN.

The substrate surface is fused silica (SiO2). The substrate is an amorphous SiO2 coating on a silicon wafer. The inert sputtering gas is argon, krypton, xenon, neon, or helium. The thin layer of single crystal zinc oxide comprises n-type zinc oxide. The substrate further comprises a thin layer of single crystal p-type zinc oxide deposited on the n-type zinc oxide.

Preferred Method: The chemical deposition process is radio frequency (RF) sputtering, chemical vapor deposition (CVD), metal organic CVD, spin coating, electrophoresis, or hydrothermal growth processes. The chemical deposition process comprises RF sputtering using an RF sputtering system comprising a zinc metal target, a substrate surface, and a plasma comprising oxygen and an inert sputtering gas, where the RF sputtering system is operated at conditions which produce the thin layer of single crystal zinc oxide on the substrate surface.

Preferred Parameter: The thin layer of zinc oxide has a thickness of less than 5 microns. The sputtering system was operated at a power of 20-150 (preferably 90-100) watts, and RF frequency of 13.56 MHz at 300-550 (preferably 350-450)degreesC for 1-40 (preferably 1-10) minutes.

FS CPI; GMPI; EPI

MC CPI: L04-C22

EPI: U11-C01J8; U12-E01A2

L57 ANSWER 28 OF 49 WPIX COPYRIGHT 2007 THE THOMSON CORP on STN

AN 2004-542265 [52] WPIX [Full-text](#)

CR 2004-506406; 2005-383295; 2006-576478; 2007-360368; 2007-698663

DNC C2004-198943 [52]

DNN N2004-428686 [52]

TI Manufacture of gallium nitride single crystal involves pressurizing chamber and generating two temperature distributions of different gradients to supersaturate solvent in nucleation region of the chamber

DC U11; U12
 IN D'EVELYN M P; HONG H; LEBOEUF S F; NARANG K J; PARK D; ROWLAND L B;
 SANDVIK P M; DEVELYN M P; LEBOEUF S; NARANG K; ROWLAND L
 PA (GENE-C) GENERAL ELECTRIC CO
 CYC 1
 PI US 20040124434 A1 20040701 (200452)* EN 14[3]
 US 7098487 B2 20060829 (200657) EN
 ADT US 20040124434 A1 US 2002-329981 20021227
 PRAI US 2002-329981 20021227
 IPCI H01L0033-00 [I,A]; H01L0033-00 [I,C]
 IPCR C30B009-00 [I,A]; C30B009-00 [I,C]; H01L0033-00
 [I,A]; H01L0033-00 [I,C]
 AB US 20040124434 A1 UPAB: 20060121
 NOVELTY - A gallium nitride single crystal is manufactured by pressurizing a chamber and generating two temperature distributions of different gradients to supersaturate a solvent in a nucleation region of the chamber. The second temperature gradient and crystal growth rate are larger than that of the second temperature gradient and second temperature distribution, respectively.
 DETAILED DESCRIPTION - Manufacture of gallium nitride (GaN) single crystal involves: providing a nucleation center in a first region (108) of a chamber (104) having a first end, a GaN source material (124) in a second region (106) of the chamber having a second end, and a GaN solvent (130) in the chamber; pressurizing the chamber; and sequentially generating first and second temperature distributions in the chamber so that the solvent is supersaturated and there are first and second temperature gradients between the two ends and GaN crystal grows on the nucleation center. The second temperature gradient and crystal growth rate are larger than the first temperature gradient and first crystal growth rate, respectively.
 INDEPENDENT CLAIMS are also included for:
 (A) a GaN single crystal obtained from the above method comprising greater than or equal to 2 mm diameter, less than 1x10⁴/cm dislocation density, and no tilt boundaries;
 (B) a semiconductor structure comprising the GaN single crystal and a layer of aluminum indium gallium nitride-containing material (Al_xIn_yGa_{1-x-y}N) disposed on the single crystal; and
 (C) semiconductor device comprising light emitting diode, laser diode, photodetector, or avalanche photodiode containing the semiconductor structure.
 $x, y = 0-y$;
 $(x+y) = 0-1$
 USE - For manufacturing GaN single crystal useful for semiconductor structure and semiconductor device (claimed).
 ADVANTAGE - The method is capable of nucleating in supercritical ammonia and other supercritical GaN solvents so that recrystallization producing small crystals rather than large crystals, improved temperature profile and improved method for mounting seed crystals are provided.
 DESCRIPTION OF DRAWINGS - The figure is a schematic cross-sectional of a capsule for making a gallium nitride single crystal.
 Chamber (104)
 Second region (106)
 First region (108)
 Porous baffle (110)
 Seed crystal (120)
 Source material (124)
 Solvent (130)
 TECH ELECTRONICS - Preferred Component: The single crystal is a wafer, or boule or ingot. The two regions are separated by a porous baffle (110).
 Preferred Condition: The chamber is pressurized to 5-80 kbar. It has a temperature of 550-1200degreesC during the manufacturing process. The first and second temperature gradients are less than 25degreesC and

5-300degreesC, respectively. The first temperature distribution is held for 1 minute to 2 hours. Preferred Method: The second temperature gradient is increased and decreased during the step of generating the second temperature distribution. The method includes generating a third temperature distribution in the chamber so that a third temperature gradient between the two ends and GaN crystal is etched from the nucleation center, providing a mineralizer to increase the solubility of GaN in the solvent, and providing a dopant source for intentional doping of n- or p-type GaN crystals.

INORGANIC CHEMISTRY - Preferred Material: The GaN single crystal is grown from a single seed or nucleus and optically transparent. It comprises p-type or preferably n-type semiconductor material. A seed crystal (120) comprises silicon carbide seed crystal or sapphire. The source material comprises single crystal GaN, amorphous GaN, polycrystalline GaN, or GaN precursor. The mineralizer comprises alkali and alkaline-earth nitrides (e.g. lithium nitride, magnesium nitride, or calcium nitride); amides (e.g. lithium amide, sodium amide, or potassium amide); urea and related compounds; ammonium salts (e.g. ammonium fluoride or ammonium chloride); azide salts (e.g. sodium azide); and/or lithium salts; or compounds formed by chemical reaction of the above materials with Ga and/or GaN. The dopant source comprises silicon, magnesium or zinc; or impurities in the GaN source. It is metals, salts, or inorganic compounds (e.g. silicon, silicon nitride, silicon chloride, magnesium nitride, magnesium fluoride, zinc, zinc fluoride, or zinc nitride).

Preferred Property: The GaN single crystal has optical absorption coefficient of below 100 (preferably below 5)/cm at wavelengths of 465-700 nm, a photoluminescence spectrum peaking at a photon energy of 3.38-3.41 eV at a crystal temperature of 300K, and dislocation density of less than 10³ (preferably less than 100)/cm.

ORGANIC CHEMISTRY - Preferred Material: The solvent comprises ammonia, hydrazine, methylamine, ethylene diamine, and/or melamine.

ORGANIC CHEMISTRY - Preferred Material: The GaN single crystal is grown from a single seed or nucleus and optically transparent. It comprises p-type or preferably n-type semiconductor material. A seed crystal (120) comprises silicon carbide seed crystal or sapphire. The source material comprises single crystal GaN, amorphous GaN, polycrystalline GaN, or GaN precursor. The mineralizer comprises alkali and alkaline-earth nitrides (e.g. lithium nitride, magnesium nitride, or calcium nitride); amides (e.g. lithium amide, sodium amide, or potassium amide); urea and related compounds; ammonium salts (e.g. ammonium fluoride or ammonium chloride); azide salts (e.g. sodium azide); and/or lithium salts; or compounds formed by chemical reaction of the above materials with Ga and/or GaN. The dopant source comprises silicon, magnesium or zinc; or impurities in the GaN source. It is metals, salts, or inorganic compounds (e.g. silicon, silicon nitride, silicon chloride, magnesium nitride, magnesium fluoride, zinc, zinc fluoride, or zinc nitride).

Preferred Property: The GaN single crystal has optical absorption coefficient of below 100 (preferably below 5)/cm at wavelengths of 465-700 nm, a photoluminescence spectrum peaking at a photon energy of 3.38-3.41 eV at a crystal temperature of 300K, and dislocation density of less than 10³

(preferably less than 100)/cm.

FS EPI

L57 ANSWER 29 OF 49 WPIX COPYRIGHT 2007 THE THOMSON CORP on STN
 AN 2004-118884 [12] WPIX Full-text
 CR 2002-443846; 2002-674752; 2003-239210
 DNC C2004-047602 [12]
 DNN N2004-095019 [12]
 TI Nanoscale articles useful as sensing elements for microneedle probes for implantation into living subjects, comprises free-standing and bulk-doped semiconductors
 DC A89; B04; D16; L03; Q68; S03; U11; U12
 IN CUI Y; DUAN X; GUDIENSEN M; GUDIENSEN M S; HUANG Y; LAUHON L J; LIANG W; LIEBER C M; PARK H; SMITH D C; WANG D; WANG J; WEI Q; ZHONG Z
 PA (CUIY-I) CUI Y; (DUAN-I) DUAN X; (GUDI-I) GUDIENSEN M; (HARD-C) HARVARD COLLEGE; (HUAN-I) HUANG Y; (LAUH-I) LAUHON L J; (LIAN-I) LIANG W; (LIEB-I) LIEBER C M; (PARK-I) PARK H; (SMIT-I) SMITH D C; (WANG-I) WANG D; (WANG-I) WANG J; (WEIQ-I) WEI Q; (ZHON-I) ZHONG Z
 CYC 103
 PI US 20030089899 A1 20030515 (200412)* EN 162 [78]
 <--
 WO 2004038767 A2 20040506 (200430) EN
 AU 2003298525 A1 20040513 (200468) EN
 AU 2003298525 A8 20051103 (200629) EN
 ADT US 20030089899 A1 Provisional US 2000-226835P 20000822; US 20030089899 A1 Provisional US 2000-254745P 20001211; US 20030089899 A1 Provisional US 2001-291896P 20010518; US 20030089899 A1 Provisional US 2001-292035P 20010518; US 20030089899 A1 Provisional US 2001-292045P 20010518; US 20030089899 A1 Provisional US 2001-292121P 20010518; US 20030089899 A1 CIP of US 2001-935776 20010822; US 20030089899 A1 Provisional US 2001-348313P 20011109; US 20030089899 A1 Provisional US 2002-354642P 20020206; US 20030089899 A1 CIP of US 2002-152490 20020520; US 20030089899 A1 US 2002-196337 20020716; AU 2003298525 A1 AU 2003-298525 20030716; WO 2004038767 A2 WO 2903-US22961 20030716; AU 2003298525 A8 AU 2003-298525 20030716
 FDT AU 2003298525 A1 Based on WO 2004038767 A; AU 2003298525 A8 Based on WO 2004038767 A
 PRAI US 2002-196337 20020716
 US 2000-226835P 20000822
 US 2000-254745P 20001211
 US 2001-291896P 20010518
 US 2001-292035P 20010518
 US 2001-292045P 20010518
 US 2001-292121P 20010518
 US 2001-935776 20010822
 US 2001-348313P 20011109
 US 2002-354642P 20020206
 US 2002-152490 20020520
 IC ICM B82B003-00
 ICS C30B029-60
 IPCR C30B0011-00 [I,A]; C30B0011-00 [I,C]; G01N0027-12 [I,A]; G01N0027-12 [I,C]; G01N0027-403 [I,C]; G01N0027-414 [I,A]; G01N0033-543 [I,A]; G01N0033-543 [I,C]; G11C0011-56 [I,A]; G11C0011-56 [I,C]; G11C0013-02 [I,A]; G11C0013-02 [I,C]; H01L0023-52 [I,C]; H01L0023-532 [I,A]; H01L0029-02 [I,C]; H01L0029-06 [I,A]; H01L0029-207 [I,A]; H01L0029-267 [I,A]; H01L0033-00 [N,A]; H01L0033-00 [N,C]; H01L0051-05 [I,C]; H01L0051-30 [I,A]

AB US 20030089899 A1 UPAB: 20060121

NOVELTY - A nanoscale article comprising a free-standing and bulk-doped semiconductor having at least one portion with smallest or maximum width of less than 500 nm, is new. The semiconductor is doped during growth.

DETAILED DESCRIPTION - INDEPENDENT CLAIMS are also included for:

- (1) a method of detecting analyte by contacting a nanoscopic wire with a sample suspected of containing analyte, e.g. DNA, and determining a change in a property of nanoscopic wire;
- (2) a sensor comprising at least one nanoscale wire, and a detector for measuring a change in a property of nanoscale wire;
- (3) a method of generating light by applying energy to semiconductor(s), causing the semiconductor to emit light;
- (4) a method of assembling elongated structures on a surface by:
 - (i) conditioning the surface with at least one functionality that attracts the elongated structures to particular positions on the surface, and aligning the elongated structures;
 - (ii) depositing elongated structures on the surface, and electrically charging the surface to produce electrostatic forces between at least two of the elongated structures;
 - (iii) dispersing the elongated structures on surface of a liquid-phase to form Langmuir-Blodgett film, compressing the film, and transferring the compressed film on a surface; or
 - (iv) dispersing the elongated structures in a flexible matrix, stretching the flexible matrix in a direction to produce a shear force on the elongated structures to align the elongated structure in the direction, removing the flexible matrix, and transferring the aligned elongated structures to a surface;
- (5) a system for growing doped semiconductor comprising a mechanism for providing molecules of semiconductor substrate and molecules of dopant, and a mechanism for doping molecules of semiconductor with the molecules of dopant during growth of semiconductor;
- (6) a system for assembling elongated structures; and
- (7) an analyte-gated field effect transistor useful as chemical and/or biological sensor, comprising a substrate of first insulating material, source and drain electrodes disposed on the substrate, a semiconductor nanowire disposed between the source and drain electrodes, and an analyte-specific binding agent disposed on surface of nanowire.

USE - The article is useful as sensing element for a microneedle probe implantable into a living subject. It is designed for use in semiconductor device; computational device; or electrical component such as Schottky diode, photodiode, light-emission source, single photon emitter, photoluminescent device, electroluminescent device, field effect transistor, bipolar junction transistor, single-electron transistor, rectifier, inverter, complimentary inverter, photodetector, p-n solar cell, single photon detector, tunnel diode, light-sensing device, gate, AND gate, NAND gate, OR gate, XOR gate, NOR gate, latch, flip-flop, register, switch, clock circuit, static memory device, dynamic memory device, programmable circuit, amplifier, analog circuit, active transistor, mixed signal device, signal processing circuit, or light-emitting diode. The article may be one of the nanoscopic wire sensors in a sensor array formed on surface of glass, polymer, or silicon dioxide-coated silicon substrate. The article may form sensing elements for an integrated dip-probe sensor, a plug-and-play sensor array (claimed)

ADVANTAGE - The article is capable of simultaneously monitoring physiological characteristics. It is capable of determining oxygen concentration, carbon dioxide concentration and/or glucose levels in a subject.

DESCRIPTION OF DRAWINGS - The figure is a schematic diagram showing nanoscale wire growth by vapor deposition in or on elongated template.

TECH INSTRUMENTATION AND TESTING - Preferred Components: The article includes a core comprising a first semiconductor and at

least one shell comprising a semiconductor different from the first semiconductor. The shell surrounds a portion of the core. The core induces a change in the shell. The shell may be an atomic monolayer or an inductive shell. The shell is delta-doped, polarizable, ferromagnetic, mechanically inducible, oxidizable, reducible, or photoactivatable. The article has more than one light-producing region. The semiconductor is elongated and has a longitudinal section. The ratio of length of longitudinal section to a longest width is greater than 4:1 (preferably greater than 1000:1). The semiconductor is a single-walled, multi-walled or unmodified nanoscopic wire having a diameter of 0.5-200 nm and an aspect ratio of more than 2, or a nanotube. It comprises a single crystal.

Preferred Dimensions: The shell has a thickness of less than 5 (preferably less than 1) nm. The smallest width is less than 200 (preferably less than 5) nm. The semiconductor has an aspect ratio of at least 100:1.

Preferred Method: Additional material(s) is applied to a surface of doped semiconductor. The doped semiconductor is grown by applying energy to a collection of molecules including molecules of semiconductor and molecules of dopant. Doping of semiconductor includes controlling an extent of doping by controlling the ratio of an amount of semiconductor molecules to an amount of dopant molecules, vaporizing the molecules using a laser to form vaporized molecules, condensing the vaporized molecules into liquid crystal, and growing the semiconductor from the liquid cluster.

ORGANIC CHEMISTRY - Preferred Components: The shell comprises functional moiety which can be activated by light, amorphous oxide, and/or reaction entity such as nucleic acid, antibody, sugar, carbohydrate, protein, or catalyst. The functional moiety is hydroxy, formyl, carboxy, sulfo, cyano, amino, mercapto, thiocarboxy, oxycarbonyl and/or halide, methyl, hydrazide, aldehyde, aryl azide, fluorinated aryl azide, or benzophenone.

POLYMERS - Preferred Components: The functional moiety may comprise a polymer chain having a chain length of less than the diameter of nanoscopic wire. The polymer is polyamide, polyester, polyimide, and/or polyacrylic. The functional moiety comprises a thin coating of metallic element, oxide, sulfide, nitride, selenide, polymer, or polymer gel covering the surface of nanoscopic wire.

INORGANIC CHEMISTRY - Preferred Material: The semiconductor comprises elemental semiconductor, e.g. silicon, germanium, tin, selenium, tellurium, boron, diamond, or phosphorus; or solid solution of elemental semiconductor, e.g. boron carbide, boron hexaphosphide, boron silicide, silicon carbide, silicon germanium, silicon tin, or germanium tin. The semiconductor may comprise IV-IV semiconductor, e.g. silicon carbide; III-V semiconductor, e.g. boron nitride/boron phosphide/boron arsenide, aluminum nitride/aluminum phosphide/aluminum arsenide/aluminum antimonide, gallium nitride/gallium phosphide/gallium arsenide/gallium antimonide, and/or indium nitride/indium phosphide/indium arsenide/indium antimonide; II-VI semiconductor, e.g. zinc oxide/zinc sulfide/zinc selenide/zinc telluride, cadmium sulfide/cadmium selenide/cadmium telluride, mercury sulfide/mercury selenide/mercury telluride, or beryllium sulfide/beryllium selenide/beryllium telluride/magnesium sulfide/magnesium selenide; IV-VI semiconductor, e.g. germanium sulfide, germanium selenide, germanium telluride, tin

sulfide, tin selenide, tin telluride, lead oxide, lead sulfide, lead selenide, or lead telluride; I-VII semiconductor, e.g. copper fluoride, copper chloride, copper bromide, copper iodide, silver fluoride, silver chloride, silver bromide, or silver iodide; and beryllium silicon nitride (BeSiN₂), calcium carbon nitride (CaCN₂), zinc germanium phosphide (ZnGeP₂), cadmium tin arsenide (CdSnAs₂), zinc tin antimonide (ZnSnSb₂), copper germanium phosphide (CuGeP₃), copper silicon phosphide (CuSi₂P₃), (Cu, Ag)(Al, Ga, In, Tl, Fe)(S, Se, Te)₂, silicon nitride (Si₃N₄), germanium nitride (Ge₃N₄), aluminum oxide, (Al, Ga, In)₂(S, Se, Te)₃, or aluminum carbon oxide (Al₂CO). The semiconductor comprises p-type dopant, e.g. boron, aluminum, indium, magnesium, zinc, cadmium, mercury, carbon, or silicon; and/or n-type dopant, e.g. phosphorus, arsenide, antimony, silicon, germanium, tin, sulfur, selenium, or tellurium.

FS CPI; GMPI; EPI

MC CPI: A12-E01; A12-V03C2; A12-W11L; B05-A01B; B05-A02; B05-A03A; B05-A03B; B05-B02A; B05-B02B; B05-B02C; B05-C03; B05-C04; B05-C08; B10-A07; B11-C04A; B11-C08E6; B12-K04A; D05-H09; D05-H10; D05-H12; D05-H18; L04-C02C; L04-E; L04-E01; L04-E01A; L04-E01D; L04-E03; L04-E05
EPI: S03-E15; U11-C01J3; U11-C02A; U11-C02J7; U11-C18B9; U12-E01B2

L57 ANSWER 30 OF 49 WPX COPYRIGTH 2007 THE THOMSON CORP ON STN

AN 2003-129712 [12] WPX Full-text

DNC C2003-033382 [12]

DNN N2003-102961 [12]

TI Light emitting diode (LED), for use in display or light emitting diode lamp, comprises superlattice formed of repeating sets of alternating layers of gallium nitride, indium gallium nitride and aluminum indium gallium nitride

DC L03; U12; X26

IN ABARE A C; BERGMANN M J; EMERSON D T

PA (ABAR-I) ABARE A C; (BERG-I) BERGMANN M J; (CREE-N) CREE INC; (EMER-I) EMERSON D T

CYC 97

PI WO 2002103814 A1 20021227 (200312)* EN 39[8]

<--

US 20030020061 A1 20030130 (200316) EN

<--

US 20030209705 A1 20031113 (200382) EN

<--

US 6664560 B2 20031216 (200382) EN

<--

EP 1397840 A1 20040317 (200420) EN

US 6734033 B2 20040511 (200431) EN

KR 2004012754 A 20040211 (200438) KO

AU 2002316258 A1 20030102 (200452) EN

<--

CN 1505843 A 20040616 (200465) ZH

JP 2004531894 W 20041014 (200467) JA 65

ADT WO 2002103814 A1 WO 2002-0519013 20020612; US 20030020061 A1

Provisional US 2001-298835P 20010615; US 20030209705 A1

Provisional US 2001-298835P 20010615; US 6664560 B2

Provisional US 2001-298835P 20010615; US 6734033 B2

Provisional US 2001-298835P 20010615; AU 2002316258 A1

AU 2002-316258 20020612; CN 1505843 A CN 2002-809205

20020612; EP 1397840 A1 EP 2002-746546 20020612; US

20030020061 A1 US 2002-170577 20020612; US 20030209705 A1

Div Ex US 2002-170577 20020612; US 6664560 B2 US
 2002-170577 20020612; US 6734033 B2 Div Ex US 2002-170577
 20020612; EP 1397840 A1 WO 2002-US19013 20020612; JP
 2004531894 W WO 2002-US19013 20020612; JP 2004531894 W
 JP 2003-506020 20020612; US 20030209705 A1 US 2003-458951
 20030610; US 6734033 B2 US 2003-458051 20030610; KR
 2004012754 A KR 2003-713558 20031016
 FDT US 6734033 B2 Div ex US 6664560 B; EP 1397840 A1 Based on WO
 2002103814 A; AU 2002316258 A1 Based on WO 2002103814 A; JP 2004531894
 W Based on WO 2002103814 A
 PRAI US 2001-298835E 20010615
 US 2002-170577 20020612
 US 2003-456051 20030610
 IC ICM H01L033-00
 IPCR H01L0033-00 [I,A]; H01L0033-00 [I,C]
 AB WO 2002103814 A1 UPAB; 20060118

NOVELTY - A light emitting diode comprises a superlattice on a gallium nitride layer formed above a silicon carbide substrate. The superlattice is formed of repeating sets of alternating layers of gallium nitride, indium gallium nitride and aluminum indium gallium nitride.

DETAILED DESCRIPTION - A light emitting diode (LED) comprises a silicon carbide (SiC) substrate (21) having a first conductivity type; a first gallium nitride (GaN) layer (25) above the substrate having the same conductivity type as the substrate; a superlattice (27) on the GaN layer formed of repeating sets of alternating layers of GaN, indium gallium nitride (InxGal-xN) and aluminum indium gallium nitride (AlxInyGal-xN); a second GaN layer (30) on the superlattice having the same conductivity type as the first GaN layer; a multiple quantum well (31) on the second GaN layer; a third GaN layer (32) on the multiple quantum well; a contact structure on the third GaN layer having the opposite conductivity type from the substrate and the first GaN layer; an ohmic contact to the substrate; and an ohmic contact to the contact structure.
 x, y, x+y = greater than 0 - less than 1.

AN INDEPENDENT CLAIM is included for the fabrication of the LED by:

- (a) growing a first GaN layer on a SiC substrate;
- (b) growing a superlattice on the first GaN layer comprising repeating sets or periods of alternating layers of GaN, InxGal-xN and AlxInyGal-xN; growing a second GaN layer on the superlattice;
- (c) growing a Group III nitride multiple quantum well on the superlattice;
- (d) growing a third GaN layer on the multiple quantum well;
- (e) growing a contact structure on the third GaN layer having the opposite conductivity type from the SiC substrate and the first GaN layer;
- (f) forming an ohmic contact to the SiC substrate; and
- (g) forming an ohmic contact to the contact structure.

USE - The light emitting diode is for use in a pixel which also comprises a red light emitting diode and a green light emitting diode. The pixel is for a display or an LED lamp. (All claimed).

ADVANTAGE - The LED can produce frequencies in the ultraviolet portion of the electromagnetic spectrum and can be incorporated into related devices and equipment, including devices that use phosphors in combination with the LED to produce white light. The superlattice provides strain relief and helps bridge the lattice constant gap between the gallium nitride portions of the device and the indium gallium nitride layers in the multiple quantum well. The superlattice also increases the effective carrier concentration and reduces the voltage required for the device. Optical quality and efficiency are improved.

DESCRIPTION OF DRAWINGS - The figure shows a cross-section of a light emitting diode.

SiC substrate (21)
 Buffer layer (22)

GaN dots (23)
 First GaN layer (25)
 Discontinuous layer of silicon nitride (26)
 Superlattice (27)
 Second GaN layer (30)
 Multiple quantum well (31)
 Third GaN layer (32)

TECH ELECTRONICS - Preferred Components: The SiC substrate and the first GaN layer have an n-type conductivity. A buffer layer (22) is on the substrate for providing a crystal and electronic transition between the substrate and the remainder of the LED. The buffer layer comprises GaN dots (23) on the surface of the substrate. A discontinuous layer of silicon nitride (Si₃N₄) (26) between the superlattice and buffer layer reduces the propagation of defects that tend to originate in the substrate. The superlattice includes 2-50 periods of alternating layers of GaN and In_xGa_{1-x}N. The In_xGa_{1-x}N layers are 15 Angstrom thick and the GaN layers are 30 Angstrom thick. Both layers are doped with silicon. The alternating layers can both be indium gallium nitride with different mole fraction combinations of indium and gallium. The alternating layers can also both be aluminum gallium indium nitride with different mole fraction combinations of aluminum, gallium and indium. The second GaN layer comprises a doped portion and an undoped portion for protecting the multiple quantum well from undesired doping. The doped portion is immediately adjacent the superlattice and the undoped portion is immediately adjacent the multiple quantum well. The multiple quantum well comprises a layer of In_xGa_{1-x}N and a layer of GaN.

$x = \text{greater than } 0 - \text{less than } 0.15$.
 At least one of the In_xGa_{1-x}N layers is undoped. At least one of the GaN layers in the multiple quantum well comprises a first portion of doped GaN and a second portion of undoped GaN with the undoped portion being immediately adjacent the undoped In_xGa_{1-x}N layers. The multiple quantum well includes at least 3, preferably at least 7 quantum wells. The thickness of each well is not more than 50 (preferably 25) Angstrom. In the multiple quantum well, x is such that the multiple quantum well produces a photon in the ultraviolet region of the electromagnetic spectrum and x and y are such that the multiple quantum well produces a photon in the ultraviolet region of the electromagnetic spectrum. The multiple quantum well emits a peak wavelength of 370-420 nm. The contact structure comprises a p-type GaN contact layer. It further comprises layer(s) of Al_xGa_{1-x}N adjacent to the p-type GaN contact layer and opposite to the ohmic contact with respect to the p-type contact layer. The third layer of GaN is doped with magnesium to produce a p-type conductivity or with silicon to produce an n-type conductivity. The multiple quantum well further comprises a phosphor responsive to the ultraviolet photon emitted by the multiple quantum well.

INORGANIC CHEMISTRY - Preferred Materials: The SiC substrate is the 6H polytype of SiC. It may have the 4H polytype of SiC for avoiding undesired absorption in the ultraviolet wavelengths. The buffer layer comprises Al_xGa_{1-x}N.
 $x = 0-1$.

The GaN dots on the surface of the substrate are covered with Al_xGa_{1-x}N caps (24). The contact structure comprises a p-type Group III nitride superlattice.

FS CPI; EPI

MC CPI: L04-A02A1A; L04-A02B1; L04-A02C1; L04-E03A
EPI: U12-A01A1A; X26-H

L57 ANSWER 31 OF 49 WPIX COPYRIGHT 2007 THE THOMSON CORP on STN
AN 2002-443846 [47] WPIX Full-text
CR 2002-674752; 2003-239210; 2004-118884
DNC C2002-126253 [47]
DNN N2002-349735 [47]
TI Manufacture of nanowire semiconductor device e.g. field
effect transistor, involves positioning first nanowire between two
contact points by applying potential between contact points
DC B04; D16; L03; P73; U11; U12
IN CUI Y; DUAN X; HUANG Y; HUANG Y S; LIEBER C M
PA (CUIY-I) CUI Y; (DUAN-I) DUAN X; (HARD-C) HARVARD COLLEGE; (HUAN-I)
HUANG Y; (LIEB-I) LIEBER C M
CYC 96
PI WO 2002017362 A2 20020228 (200247)* EN 173[33]
--
AU 2001086649 A 20020304 (200247) EN
--
US 20020130311 A1 20020919 (200264) EN
--
EP 1314189 A2 20030528 (200336) EN
--
KR 2003043938 A 20030602 (200366) KO
--
KR 2003055346 A 20030702 (200377) KO
--
JP 2004507104 W 20040304 (200417) JA 276
CN 1550030 A 20041124 (200516) ZH
US 20050164432 A1 20050728 (200550) EN
MX 2003001605 A1 20050701 (200628) ES
US 20070026645 A1 20070201 (200712) EN
US 20070032023 A1 20070208 (200713) EN
US 20070032051 A1 20070208 (200713) EN
US 20070032052 A1 20070208 (200713) EN
US 20070048492 A1 20070301 (200718) EN
US 7211464 B2 20070501 (200730) EN
AU 2001286649 B2 20070405 (200763) EN
ADT WO 2002017362 A2 WO 2001-US26298 20010822; US 20020130311 A1
Provisional US 2000-226835P 20000822; US 20050164432 A1
Provisional US 2000-226835P 20000822; US 20070026645 A1
Provisional US 2000-226835P 20000822; US 20070032023 A1
Provisional US 2000-226835P 20000822; US 20070032052 A1
Provisional US 2000-226835P 20000822; US 20070032051 A1
Provisional US 2000-226835P 20000822; US 20070048492 A1
Provisional US 2000-226835P 20000822; US 7211464 B2
Provisional US 2000-226835P 20000822; US 20020130311 A1
Provisional US 2000-254745P 20001211; US 20050164432 A1
Provisional US 2000-254745P 20001211; US 20070026645 A1
Provisional US 2000-254745P 20001211; US 20070032023 A1
Provisional US 2000-254745P 20001211; US 20070032052 A1
Provisional US 2000-254745P 20001211; US 20070032051 A1
Provisional US 2000-254745P 20001211; US 20070048492 A1
Provisional US 2000-254745P 20001211; US 7211464 B2
Provisional US 2000-254745P 20001211; US 20020130311 A1
Provisional US 2001-291896P 20010518; US 20020130311 A1
Provisional US 2001-292035P 20010518; US 20020130311 A1
Provisional US 2001-292045P 20010518; US 20020130311 A1
Provisional US 2001-292121P 20010518; US 20050164432 A1

Provisional US 2001-291896P 20010518; US 20050164432 A1
 Provisional US 2001-292035P 20010518; US 20050164432 A1
 Provisional US 2001-292045P 20010518; US 20050164432 A1
 Provisional US 2001-292121P 20010518; US 20070026645 A1
 Provisional US 2001-291896P 20010518; US 20070026645 A1
 Provisional US 2001-292035P 20010518; US 20070026645 A1
 Provisional US 2001-292045P 20010518; US 20070026645 A1
 Provisional US 2001-292121P 20010518; US 20070032023 A1
 Provisional US 2001-291896P 20010518; US 20070032023 A1
 Provisional US 2001-292035P 20010518; US 20070032023 A1
 Provisional US 2001-292045P 20010518; US 20070032023 A1
 Provisional US 2001-292121P 20010518; US 20070032023 A1
 Provisional US 2001-291896P 20010518; US 20070032052 A1
 Provisional US 2001-292035P 20010518; US 20070032052 A1
 Provisional US 2001-292045P 20010518; US 20070032052 A1
 Provisional US 2001-292121P 20010518; US 20070032051 A1
 Provisional US 2001-291896P 20010518; US 20070032051 A1
 Provisional US 2001-292035P 20010518; US 20070032051 A1
 Provisional US 2001-292045P 20010518; US 20070032051 A1
 Provisional US 2001-292121P 20010518; US 20070048492 A1
 Provisional US 2001-291896P 20010518; US 20070048492 A1
 Provisional US 2001-292035P 20010518; US 20070048492 A1
 Provisional US 2001-292045P 20010518; US 20070048492 A1
 Provisional US 2001-292121P 20010518; US 7211464 B2
 Provisional US 2001-291896P 20010518; US 7211464 B2
 Provisional US 2001-292035P 20010518; US 7211464 B2
 Provisional US 2001-292045P 20010518; US 7211464 B2
 Provisional US 2001-292121P 20010518; AU 2001086649 A
 AU 2001-86649 20010822; CN 1550030 A CN 2001-816168
 20010822; EP 1314189 A2 EP 2001-966109 20010822; US
 20020130311 A1 US 2001-935776 20010822; US 20050164432 A1
 Div Ex US 2001-935776 20010822; US 20070026645 A1 Cont of
 US 2001-935776 20010822; US 20070032023 A1 Div Ex US
 2001-935776 20010822; US 20070032052 A1 Cont of US
 2001-935776 20010822; US 20070032051 A1 Cont of US
 2001-935776 20010822; US 20070048492 A1 Cont of US
 2001-935776 20010822; US 7211464 B2 Div Ex US 2001-935776
 20010822; EP 1314189 A2 WO 2001-US26298 20010822; JP
 2004507104 W WO 2001-US26298 20010822; MX 2003001605 A1
 WO 2001-US26298 20010822; JP 2004507104 W JP 2002-521336
 20010822; MX 2003001605 A1 MX 2003-1605 20030221; KR
 2003043938 A KR 2003-762636 20030222; KR 2003055346 A
 KR 2003-797723 20030610; US 20050164432 A1 US 2005-82372
 20050317; US 20070032023 A1 Cont of US 2005-82372 20050317; US 7211464
 B2 US 2005-82372 20050317; US 20070026645 A1 US 2006-543326 20061004;
 US 20070032051 A1 US 2006-543336 20061004; US 20070048492 A1 US
 2006-543337 20061004; US 20070032023 A1 US 2006-543352 20061004; US
 20070032052 A1 US 2006-543746 20061004; AU 2001286649 B2 AU
 2001-286649 20010822
 FDT AU 2001086649 A Based on WO 2002017362 A; EP 1314189 A2 Based
 on WO 2002017362 A; JP 2004507104 W Based on WO 2002017362 A; MX
 2003001605 A1 Based on WO 2002017362 A; AU 2001286649 B2 Based
 on WO 2002017362 A
 PRAI US 2001-292121P 20010518
 US 2000-226835P 20000822
 US 2000-254745P 20001211
 US 2001-292045P 20010518
 US 2001-292035P 20010518
 US 2001-291896P 20010518
 US 2001-935776 20010822

US 2005-82372 20050317
 US 2006-543326 20061004
 US 2006-543336 20061004
 US 2006-543352 20061004
 US 2006-543746 20061004
 US 2006-543337 20061004

IC ICM G01N027-00; H01L021-18; H01L029-06
 ICS H01L021-329; H01L021-331; H01L027-10; H01L029-73; H01L029-88;
 H01L033-00

IPCI B32B0005-00 [I,A]; B32B0005-00 [I,C]; D01C0005-00 [N,A]; D01C0005-00 [N,C]; D01F0009-12 [N,A]; D01F0009-12 [N,C]; H01G0009-20 [I,A]; H01G0009-20 [I,C]; H01L0021-00 [I,A]; H01L0021-00 [I,C]; H01L0021-02 [I,C]; H01L0021-20 [I,A]; H01L0021-336 [I,A]; H01L0051-05 [I,C]; H01L0051-40 [I,A]; C30B0011-00 [I,A]; C30B0011-00 [I,C]; C30B0025-00 [I,A]; C30B0025-00 [I,C]; G01N0027-12 [I,A]; G01N0027-12 [I,C]; G01N0027-403 [I,C]; G01N0027-414 [I,A]; G01N0033-543 [I,A]; G01N0033-543 [I,C]; G11C0013-02 [I,A]; G11C0013-02 [I,C]; H01L0021-02 [I,C]; H01L0021-329 [I,A]; H01L0021-331 [I,A]; H01L0023-52 [I,C]; H01L0023-532 [I,A]; H01L0027-10 [I,A]; H01L0027-10 [I,C]; H01L0029-02 [I,C]; H01L0029-06 [I,A]; H01L0029-207 [I,A]; H01L0029-267 [I,A]; H01L0029-66 [I,C]; H01L0029-73 [I,A]; H01L0029-88 [I,A]; H01L0033-00 [I,A]; H01L0033-00 [I,C]; H01L0051-30 [I,A]

IPCR C30B0011-00 [I,A]; C30B0011-00 [I,C]; C30B0025-00 [I,A]; C30B0025-00 [I,C]; G01N0027-12 [I,A]; G01N0027-12 [I,C]; G01N0027-403 [I,C]; G01N0027-414 [I,A]; G01N0033-543 [I,A]; G01N0033-543 [I,C]; G11C0013-02 [I,A]; G11C0013-02 [I,C]; H01L0021-02 [I,C]; H01L0021-329 [I,A]; H01L0021-331 [I,A]; H01L0023-52 [I,C]; H01L0023-532 [I,A]; H01L0027-10 [I,A]; H01L0027-10 [I,C]; H01L0029-02 [I,C]; H01L0029-06 [I,A]; H01L0029-207 [I,A]; H01L0029-267 [I,A]; H01L0029-66 [I,C]; H01L0029-73 [I,A]; H01L0029-88 [I,A]; H01L0033-00 [N,A]; H01L0033-00 [N,C]; H01L0033-00 [I,A]; H01L0033-00 [I,C]; H01L0051-05 [I,C]; H01L0051-30 [I,A]

AB WO 2002017362 A2 UPAB; 20060119

NOVELTY - A nanowire semiconductor device is manufactured by positioning a first nanowire between two contact points by applying a potential between the contact points; and positioning a second nanowire between two other contact points.

DETAILED DESCRIPTION - INDEPENDENT CLAIMS are also included for:

- (1) a bulk-doped semiconductor comprising a single crystal; an elongated and bulk-doped semiconductor that, at any point (15) along its longitudinal axis (13), has a largest cross-section (16) of less than 500 nm, and a free standing and bulk-doped semiconductor with at least one portion having smallest width (14) of less than 500 nm, where a phenomena produced by a section of the bulk-doped semiconductor exhibits a quantum confinement caused by a dimension of the section;
- (2) a solution and a device comprising the doped semiconductor;
- (3) a collection of reagents for growing a doped semiconductor;
- (4) a method of growing a semiconductor comprising doping the semiconductor during growth of the semiconductor;
- (5) a method of fabricating a device comprising contacting semiconductors to a surface;
- (6) a method of generating light by applying energy to semiconductors causing the semiconductors to emit light;
- (7) a process for controllably assembling a semiconductor device having elongated elements with a dimension in a transverse direction of the element on nanometer scale comprising producing first elements of a first doping type, orienting the first element in a first direction, and connecting the first element to a first contact to allow an electrical current to flow through the first element;

(8) a method for manufacturing a light-emitting diode from nanowires where the diode has an emission wavelength determined by a dimension of a p-n junction between two doped nanowires;

(9) a method for manufacturing a semiconductor junction by crossing a p-n-type nanowires;

(10) a method of assembling elongated structures on a surface comprising flowing a fluid having elongated structures on the surface, and aligning the elongated structures on the surface to form an array of the elongated structures; and

(11) a system for growing a doped semiconductor comprising mechanism for providing a molecules of the semiconductor and molecules of a dopant; and mechanism for doping molecules of the semiconductor with the molecules of the dopant during growth of the semiconductor to produce the doped semiconductor.

USE - For manufacture of nanowire semiconductor device e.g. field effect transistor, bipolar transistors, complementary inverters or tunnel diodes.

ADVANTAGE - The invented method is an environmentally friendly fabrication at lower cost.

DESCRIPTION OF DRAWINGS - The figure shows a perspective view of a semiconductor article or nanowire.

Length (12)

Longitudinal axis (13)

Width (14)

Point (15)

Cross-section (16)

TECH ELECTRONICS - Preferred Components: The semiconductor comprises an interior core comprising a first semiconductor; and exterior shells exterior to the interior core. It also comprises group IV-group IV semiconductor. The transistor comprises a bipolar junction transistor or field effect transistor. Preferred Device: The device comprises a switch, diode, light-emitting diode, tunnel diode or Schottky diode. It also comprises an (complementary) inverter, an optical sensor or a sensor for an analyte.

Preferred Dimension: The smallest width is less than 200, preferably less than 5 nm. The longitudinal section, a ratio of the length (L2) of the section to a longest width is greater than 4:1, preferably 1000:1.

Preferred Method: The method further comprises adding materials to a surface of the doped semiconductor. The doped semiconductor is grown by applying energy to a collection of molecules having molecules of semiconductor and molecules of dopant. The molecules are vaporized using a laser. The semiconductor is grown from the vaporized molecules. The vaporized molecules are condensed into a liquid cluster.

POLYMERS - Preferred Component: The flexible matrix is a polymer.

INORGANIC CHEMISTRY - Preferred Component: The elemental semiconductor is silicon (Si), germanium (Ge), tin (Sn), selenium, tellurium, diamond or phosphorus (P). The solid solution is boron (B)-carbon, B-P (BP6), B-Si, Si-C, Si-Ge, Si-Sn or Ge-Sn. The group IV semiconductor is silicon carbide

. The semiconductor comprises group III-group V semiconductor from boron nitride/boron phosphide, boron arsenide, aluminum nitride/aluminum phosphide/aluminum arsenide/aluminum-antimony, gallium nitride/gallium phosphide/gallium arsenide/gallium-antimony, indium nitride/indium phosphide/indium arsenide/indium-antimony. It can also be zinc oxide/zinc sulfide/zinc selenide/zinc telluride, cadmium sulfide/cadmium selenide/cadmium telluride, mercuric sulfide/mercuric

selenide/mercuric telluride or beryllium sulfide/beryllium selenide/beryllium telluride/magnesium sulfide/magnesium selenide. It can also be germanium sulfide, germanium selenide, germanium telluride, tin sulfide, tin selenide, tin telluride, lead oxide, lead sulfide, lead selenide or lead telluride. It can also be copper fluoride, copper chloride, copper bromide, copper iodide, silver fluoride, silver chloride, silver bromide or silver iodide. It can also be BeSiN₂, calcium cyanide, zinc germanium phosphide, CdSnAs₂, ZnSnSb₂, CuGeP₃, CuSi₂P₃, (copper, silver) (aluminum (Al), gallium, indium (In), Thallium, iron) (sulfur (S), Se, Te)₂, silicon nitride, germanium nitride, aluminum oxide, (Al, Ga, In)₂(S, Se, Te)₃ or Al₂CO (3ic). It also comprises a p-type dopant from B, Al or In and an n-type dopant from P, arsenic, or lead. It also comprises manganese. The p-dopant can be magnesium, zinc, cadmium or mercury. It can also be C or Si. The n-type can be Si, Ge, Sn, S, Se or Te.

BIOTECHNOLOGY - Preferred Analyte: The analyte is deoxyribonucleic acid.

FS CPI; GMPI; EPI

MC CPI: B04-C03; B04-E01; B05-A02; B05-A03; B05-A04; B05-C06; B11-C08B; B12-K04; D05-H12; L03-G04A; L04-E01A; L04-E02
EPI: U11-C18A3; U12-A01A; U12-B03F2A; U12-D02D; U12-E01B2

L57 ANSWER 32 OF 49 WPIX COPYRIGHT 2007 THE THOMSON CORP on STN

AN 2001-112348 [12] WPIX Full-text

DNC C2001-033388 [12]

DNN N2001-082494 [12]

TI Epitaxial silicon carbide film useful in fabricating electronic devices has epitaxial growth on an offcut surface having a specific offcut angle and a crystallographic direction

DC E36; L03; P73; U11; U12

IN BRANDES G R; LANDINI B E; TISCHLER M A

PA (ADTE-N) ADVANCED TECHNOLOGY MATERIALS; (BRAN-I) BRANDES G R; (LAND-I) LANDINI B E; (TISC-I) TISCHLER M A

CYC 81

PI WO 2000079570 A2 20001228 (200112)* EN 33[8]

<--

AU 2000076993 A 20010109 (200122) EN

<--

US 6329088 B1 20011211 (200204) EN

<--

US 20020059898 A1 20020523 (200239) EN

<--

EP 1214190 A2 20020619 (200240) EN

<--

KR 2002021383 A 20020320 (200264) KO

<--

JP 20030502857 W 20030121 (200308) JA 43

<--

CN 1377311 A 20021030 (200314) ZH

<--

US 6641938 B2 20031104 (200374) EN

<--

CN 1164417 C 20040901 (200615) ZH

ADT WO 2000079570 A2 WO 2000-US15155 20000601; US 6329088 B1

US 1999-339510 19990624; US 20020059898 A1 Cont of US

1999-339510 19990624; US 6641938 B2 Cont of US 1999-339510

15990624; AU 2000076993 A AU 2000-76993 20000601; CN 1377311 A CN 2000-809431 20000601; EP 1214190 A2 EP 2000-966685 20000601; EP 1214190 A2 WO 2000-US15155 20000601; JP 2003502857 W WO 2000-US15155 20000601; JP 2003502857 W JP 2001-505042 20000601; US 20020059898 A1 US 2001-1476 20011101; US 6641938 B2 US 2001-1476 20011101; KR 2002021383 A KR 2001-716473 20011221; CN 1164417 C CN 2000-809431 20000601

FDT US 6641938 B2 Cont of US 6329088 B; AU 2000076993 A Based on WO 2000079570 A; EP 1214190 A2 Based on WO 2000079570 A; JP 2003502857 W Based on WO 2000079570 A

PRAI US 1999-339510 19990624
US 2001-1476 20011101

IC ICM H01L021-20; H01L021-205

IPCR C30B0023-02 [I,A]; C30B0023-02 [I,C];
C30B0025-02 [I,A]; C30B0025-02 [I,C];
C30B0029-10 [I,C]; C30B0029-36 [I,A]; H01L0021-02 [I,C]; H01L0021-04 [I,A]; H01L0021-20 [I,A]; H01L0021-205 [I,A];
H01L0029-02 [I,C]; H01L0029-04 [I,A]; H01L0029-24 [I,A]

AB WO 2000079570 A2 UPAB: 20050901

NOVELTY - An epitaxial silicon carbide film grown on an offcut surface of a silicon substrate. The substrate has a hexagonal crystal structure. The offcut surface having an offcut angle of 6-10 degrees and a crystallographic direction of the offcut surface is towards one of the six equivalent (1100) directions of the substrate +/- 7.5 degrees.

DETAILED DESCRIPTION - INDEPENDENT CLAIMS are also included for:

(1) a method of forming a silicon carbide (SiC) epitaxial film comprising depositing the film on a SiC substrate of hexagonal crystal form towards the (1100) crystalline direction of the substrate; and

(2) a silicon carbide article comprising the above silicon carbide substrate.

USE - Useful in fabricating electronic devices, e.g., SiC metal oxide semiconductor field effect transistors (MOSFETs).

ADVANTAGE - The film has a smooth surface morphology within the edge exclusion area having a root mean square roughness not more than 2, preferably less than 1 nm. It has a uniform thickness and a low defect density that is compatible with microelectronic device applications. The invention permits unexpectedly higher doping levels to be achieved on the (1100) offcut epilayers compared to the (1120) offcut epilayers.

DESCRIPTION OF DRAWINGS - The figure shows a schematic representation of a hexagonal SiC structure.

TECH INORGANIC CHEMISTRY - Preferred Substrate: The SiC substrate is a 4H-SiC (0001) or a 6H-SiC. The film is doped with an n-type and/or p-type dopant species at laterisk 10 power13-lasterisk10 power 21 atoms/cm3. Preferred Component: The film comprises a microelectronic device structure formed on/in the film. Preferred Compound: The dopant source is nitrogen, aluminum, phosphorus, boron, or vanadium. Preferred Properties: The offcut angle is 7-9, preferably 8 degrees. The offcut direction is towards one of the six equivalent (100) direction +/- 5, preferably 1.5 degrees. Preferred Condition: The film is grown under a sub-atmospheric pressure conditions using silicon hydride and methane with a hydrogen gas carrier as a gaseous source medium and at 1450-1650 degreesC.

FS CFI; GMP; EPI

MC CFI: E31-P06C; L04-A; L04-C01; L04-E01B1
EPI: U11-A01X; U11-C01J1; U12-D02A

L57 ANSWER 33 OF 49 WPIX COPYRIGHT 2007 THE THOMSON CORP on STN
 AN 2000-197486 [18] WPIX Full-text
 CR 1997-244553; 1999-069948; 2000-070492; 2002-187303
 DNC C2000-061358 [18]
 DNN N2000-146400 [18]
 TI Silicon carbide substrate for discrete or integrated circuit devices has a top surface which does not include exposed pores, scratches, steps or other depressions or discontinuities having dimension(s) larger than a specified value
 DC L03; U11
 IN SULLIVAN T M
 PA (SULL-I) SULLIVAN T M
 CYC 26
 PI EP 986102 A2 20000315 (200018)* EN 11[4]
 <--
 US 6077619 A 20000620 (200035) EN
 <--
 ADT EP 986102 A2 EP 1999-400965 19990420; US 6077619 A CIP of US 1994-332419 19941031; US 6077619 A CIP of US 1996-624824 19960327; US 6077619 A US 1998-63405 19980421
 FDT US 6077619 A CIP of US 5623386 A; US 6077619 A CIP of US 5850329 A
 PRAI US 1998-63405 19980421
 US 1994-332419 19941031
 US 1996-624824 19960327
 IPCR G11B0017-02 [I,A]; G11B0017-02 [I,C]; G11B0017-038 [I,A]; G11B0021-16 [I,A]; G11B0021-16 [I,C]; G11B0025-04 [I,A]; G11B0025-04 [I,C]; G11B0033-02 [I,A]; G11B0033-02 [I,C]; G11B0005-00 [I,A]; G11B0005-00 [I,C]; G11B0005-10 [I,A]; G11B0005-10 [I,C]; G11B0005-187 [I,A]; G11B0005-187 [I,C]; G11B0005-48 [I,A]; G11B0005-48 [I,C]; G11B0005-62 [I,C]; G11B0005-72 [I,A]; G11B0005-72 [I,C]; G11B0005-73 [I,A]; G11B0005-74 [I,A]; G11B0005-74 [I,C]; G11B0005-82 [I,A]; G11B0005-82 [I,C]; H01L0021-02 [I,A]; H01L0021-02 [I,C]; H01L0021-04 [I,A]; H01L0023-12 [I,C]; H01L0023-15 [I,A]
 AB EP 986102 A2 UPAB: 20050410
 NOVELTY - Silicon carbide substrate (1) has a top surface with an exposed polycrystalline (111) crystal plane. The top surface has no exposed pores, scratches, steps or other depressions or discontinuities having at least one dimension larger than 2.54 microns and no non-stoichiometric silicon or carbon other than that which may be residual from the process of making silicon carbide ceramic material.
 DETAILED DESCRIPTION - INDEPENDENT CLAIMS are also included for the following:
 (a) A wafer substrate component used for making discrete or integrated circuit electronic devices having a working surface. At least part of the working surface comprises a polycrystalline silicon carbide outer surface with (111) crystallographic planes exposed on the working surface. The outer surface has no exposed pores, scratches, steps or other depressions or discontinuities having at least one dimension larger than 0.1 microns and no non-stoichiometric silicon or carbon other than that which may be residual from the process of making silicon carbide ceramic material.
 (b) A laminate comprising either of the above substrates and a nonmagnetic thin film coating on the outer surface.
 (c) An integrated circuit electronic device including the laminate structure.
 (d) A discrete device including the laminate structure.
 USE - The substrate is used to support circuit lines, transistors, capacitors, resistors, semiconducting light emitting and sensing devices, lasers and other discrete and integrated components of electronic devices such as integrated circuits (claimed) and discrete devices (claimed).

ADVANTAGE - The silicon carbide wafer substrate has a reduced cost per unit of surface area. The substrate is capable of increased device packing density. The electronic device reliability is improved at high operating temperature and high frequency. The speed of the device is increased by providing a substrate with high dielectric strength at high frequency.

DESCRIPTION OF DRAWINGS - The diagram shows a cross-sectional view of a polished substrate made in accordance with some of the embodiments of the invention.

Silicon carbide ceramic surface (1)

Silicon carbide monolith (3)

Pores (7)

TECH INORGANIC CHEMISTRY - Preferred Substrate: The dimension is no larger than 0.1 micron. The substrate is finished to less than 5 Angstrom Ra on the portion of the wafer that is used to support laminates and less than 20 Angstrom Ra on the surface opposite the working surface. Preferred Laminate: The thin film coating is selected from a metallic material, an electrical insulating material, a ferroelectric material, a resistive material, a semiconductor material, and a light emitting or sensing material. The metallic material contains gold, aluminum, silver or copper. The electrically insulating material is one of silicon monoxide, silicon dioxide, silicon nitride, or beryllium oxide. The ferroelectric material is one of tantalum dioxide, barium ferrite, or perovskite. The semiconductor layer is one or more of beta silicon carbide, gallium nitride, indium nitride, or aluminum nitride. The light emitting or sensing material is selected from the group including gallium nitride, indium nitride aluminum nitride, or compositions thereof.

Nitrogen or phosphorus are used to modify carrier concentration in silicon carbide as

n-type dopants. Aluminum or

boron are used to modify hole concentration in silicon carbide as p-type dopants.

Silicon is used to modify carrier concentration in gallium nitride, indium nitride, aluminum nitride, or compositions thereof as an n-type dopant

. Magnesium is used to modify the hole concentration in gallium nitride, indium nitride, aluminum nitride, or compositions thereof as a p-type dopant.

FS CPI; EPI

MC CPI; L04-C22

EPI: U11-A01A1; U11-A01D; U11-A05B; U11-B03

L57 ANSWER 34 OF 49 WPIX COPYRIGHT 2007 THE THOMSON CORP on STN

AN 1998-236739 [21] WPIX Full-text

DNC C1998-073921 [21]

DNN N1998-187852 [21]

TI Preparing semiconductor for luminescent device - by growing aluminum nitride buffer layer on semiconductor layer of silicon carbide, and growing single crystal layer of III-V semiconductor

DC L03; U11; U12; V08

IN BAN Y; HARA Y; ISHIBASHI A; KAMIMURA N; KUME M; UEMURA N

PA (MATU-C) MATSUSHITA DENKI SANGYO KK; (MATU-C) MATSUSHITA ELECTRIC IND CO INC; (MATU-C) MATSUSHITA ELECTRIC IND CO LTD

CYC 3

PI JP 10075018 A 19980317 (199821)* JA 12[10]
 <--
 KR 98006657 A 19980330 (199905) KO
 <--
 US 5923950 A 19990713 (199934) EN
 <--
 US 6281522 B1 20010828 (200151) EN
 <--
 KR 449074 B 20041126 (200523) KO

ADT JP 10075018 A JP 1997-143868 19970602; US 5923950 A US
 1997-872154 19970610; US 6281522 B1 Div Ex US 1997-872154
 19970610; KR 98006657 A KR 1997-24554 19970613; KR
 449074 B KR 1997-24554 19970613; US 6281522 B1 US
 1999-243462 19990203

FDT KR 449074 B Previous Publ KR 98006657 A

PRAI JP 1996-153953 19960614

IC ICM H01S003-00

IPCR C23C0016-18 [I,A]; C23C0016-18 [I,C]; C30B0029-10 [I,C];
 C30B0029-40 [I,A]; H01L0021-02 [I,C]; H01L0021-02 [I,C];
 H01L0021-20 [I,A]; H01L0021-205 [I,A]; H01L0021-205 [I,A]; H01L0033-00
 [I,A]; H01L0033-00 [I,A]; H01L0033-00 [I,C]; H01L0033-00 [I,C];
 H01S0005-00 [I,A]; H01S0005-00 [I,C]; H01S0005-323 [I,A]

AB JP 10075018 UFAB: 20050828

Preparation method of a semiconductor comprises: (a) growing buffer layer
 consisting of AlN at thickness of 10-25 nm on a semiconductor layer consisting
 of silicon carbide, and (b) growing single crystal layer of the following
 formula, $\text{Al}_x\text{Ga}_{1-x}\text{In}_y\text{N}$, where x=real number of 0-1, y=real number of 0-1, and
 $x+y$ =real number of up to 1, on the buffer layer.

USE - The method is used for preparation of semiconductor to be used for
 LED or semiconductor laser diodes.

ADVANTAGE - Single crystal layer, having improved surface flatness, can
 be obtd. Formation of p-n junction on the n-type semiconductor substrate can be
 easily done. Electrode can be formed on the surface of the opposite side to the
 main surface at the buffer layer side of the semiconductor substrate. The structure
 can be made simple. N-Ga single crystal layer in high quality can be obtd.

ABDT JP10075018

Preparation method of a semiconductor comprises:
 (a) growing buffer layer consisting of AlN at thickness of 10-25
 nm on a semiconductor layer consisting of
 silicon carbide, and
 (b) growing single crystal layer of the following formula,
 $\text{Al}_x\text{Ga}_{1-x}\text{In}_y\text{N}$, where x=real number of 0-1, y=real number of 0-1, and
 $x+y$ =real number of up to 1, on the buffer layer.

USE

The method is used for preparation of semiconductor to be used
 for LED or semiconductor laser diodes.

ADVANTAGE

Single crystal layer, having improved surface flatness, can
 be obtd. Formation of p-n junction on the n-type
 semiconductor substrate can be easily done.
 Electrode can be formed on the surface of the opposite side to the
 main surface at the buffer layer side of the semiconductor
 substrate. The structure can be made simple. N-Ga single
 crystal layer in high quality can be obtd.

PREFERRED METHOD

The growing of the buffer layer comprises growing buffer layer at
 1000°C or higher temperature. The growing of the buffer layer
 comprises growing buffer layer without doping impurities.
 The preparation method comprises (a) growing buffer layer consisting of
 AlGaIn at thickness of 10-25 nm on a semiconductor

layer consisting of silicon carbide, and (b) growing single crystal layer of the following formula, $\text{Al}_x\text{Ga}_{1-x}\text{In}_y\text{N}$, where x =real number of 0-1, y =real number of 0-1, and $x+y$ =real number of up to 1, on the buffer layer. (KR)

FS CPI; EPI

MC CPI: L04-A02D; L04-C01B; L04-C12B; L04-E03

EPI: U11-C01J3A; U12-A01B1A; U12-A01B1B; U12-A01B2; U12-A01B6; V08-A01D; V08-A04A

L57 ANSWER 35 OF 49 WPIX COPYRIGHT 2007 THE THOMSON CORP on STN

AN 1992-260800 [32] WPIX Full-text

DNC C1992-116466; C1994-033725 [21] [09]

DNN N1992-199418; N1994-058037 [21] [09]

TI Crystal growth on nitride semiconductor - having semiconductor buffer layer for improved crystallinity of semiconductor growth giving improved electrical performance

DC L03; U11; U12; V08

IN NAKAMURA S

PA (NICH-N) NICHIA KAGAKU KOGYO; (NICH-N) NICHIA KAGAKU KOGYO KK

CYC 6

PI EP 497350 A1 19920805 (199232)* EN 18[12]

<--

JP 04297023 A 19921021 (199249) JA 7

<--

US 5290393 A 19940301 (199409) EN 16

<--

EP 497350 B1 19950802 (199535) EN 21[12]

<--

DE 69203736 E 19950907 (199541) DE

<--

JP 07312350 A 19951128 (199605) JA 8[10]

<--

KR 9506968 B1 19950626 (199714) KO

<--

JP 10294492 A 19981104 (199903) JA 7[10]

<--

EP 497350 B2 20020109 (200211) EN

<--

JP 3257344 B2 20020218 (200219) JA 8

<--

JP 2002154900 A 20020528 (200238)# JA 13

<--

JP 3478287 B2 20031215 (200401)# JA 7

<--

ADT EP 497350 A1 EP 1992-101560 19920130; JP 04297023 A JP

1991-89840 19910327; JP 07312350 A Div Ex JP 1991-89840

19910327; JP 10294492 A Div Ex JP 1991-89840 19910327;

JP 3257344 B2 Div Ex JP 1991-89840 19910327; US 5290393 A

US 1992-826997 19920128; DE 69203736 E DE 1992-69203736

19920130; EP 497350 B1 EP 1992-101560 19920130; DE

69203736 E EP 1992-101560 19920130; KR 9506968 B1 KR

1992-1542 19920131; JP 07312350 A JP 1995-152676 19910327

; JP 3257344 B2 JP 1995-152676 19910327; JP 2002154900 A Div

Ex JP 1995-152676 19910327; JP 3478287 B2 Div Ex JP

1995-152676 19910327; JP 10294492 A JP 1998-29224

19910327; JP 2002154900 A JP 2001-266561 19910327; JP

3478287 B2 JP 2001-266561 19910327

FDT DE 69203736 E Based on EP 497350 A; JP 3257344 B2 Previous Publ JP

07312350 A; JP 3478287 B2 Previous Publ JP 2002154900 A

PRAI JP 1991-89840 19910327
 JP 1991-32259 19910131
 JP 1998-152676 19910327
 JP 1998-29224 19910327
 JP 2001-266561 19910327

IC ICM C30B025-02

IPCR C23C0016-18 [I,A]; C23C0016-18 [I,C]; C30B0025-02 [I,A];
 C30B0025-02 [I,C]; C30B0029-10 [I,C];
 C30B0029-38 [I,A]; H01L0021-02 [I,C]; H01L0021-02 [I,C];
 H01L0021-20 [I,A]; H01L0021-205 [I,A]; H01L0021-205 [I,A]; H01L0033-00
 [I,A]; H01L0033-00 [I,A]; H01L0033-00 [I,A]; H01L0033-00 [I,C];
 H01L0033-00 [I,C]; H01L0033-00 [I,C]; H01S0005-00 [I,A]; H01S0005-00
 [I,C]; H01S0005-323 [I,A]

AB EP 497350 A1 UPAB: 20060107

Crystal growth method for gallium nitride compound semiconductor with steps
 of: A) Vapour growing buffer layer of $Ga_{x-1}Al_1N_x$ ($x=0-1$) on a substrate at
 first temperature. B) Vapour growing semiconductor layer of $Ga_{x-1}Al_1N_x$ ($x=0-1$)
 on a substrate at second temperature higher than first. Pref. 1) further
 alternate layers of buffer and semiconductor are grown in the same way; 2) the
 buffer and semiconductor layers are n or p type doped with, n type Si or Sn,
 and p
 type any one from ZnMgCa and Be to 10 power17 - 10 power20 cm3. 3) Buffer
 layer is grown using a reaction gas containing at least one from trimethyl
 gallium, triethyl gallium; at least one from ammonia gas or and hydrazine;
 trimethyl aluminium; at least one from cyclopentadienyl magnesium, diethyl
 zinc, trimethyl zinc to a thickness of 0.001-0.5 micron 4) Substrate is one
 from sapphire, Si, SiC and Gats. 5) First temperature is 200-900 deg.C, second
 temperature is 900-1150 deg.C. 6) After formation of the semiconductor layer
 it is irradiated with an electron beam.

ADVANTAGE - Crystallinity of the semiconductor layer grown onto buffer
 layer is improved.

FS CPI; EPI

MC CPI: L04-A02; L04-C01; L04-C01B; L04-E03B
 EPI: U11-C01J1; U11-C01J3A; U11-C01J8; U11-C08A6; U12-A01A1A

L57 ANSWER 36 OF 49 WPIX COPYRIGHT 2007 THE THOMSON CORP on STN

AN 1986-299428 [46] WPIX Full-text

DNC C1986-129732 [21]

DNN N1986-223800 [21]

TI Production of semiconducting single crystalline
 silicon carbide film - by CVD on silicon
 substrate and growing F-type doped
 silicon carbide

DC E36; L03; U11

IN FURUKAWA K; FURUKAWA M; SHIGETA M; SUZUKI A

PA (SHAF-C) SHARP KK

CYC 2

EI DE 3613021 A 19861106 (198646)* DE 9[1]

<--

JP 61242998 A 19861029 (198650) JA

<--

DE 3613021 C2 19931118 (199346) DE 4[1]

<--

ADT DE 3613021 A DE 1986-3613021 19860417; JP 61242998 A JP

1986-84235 19860418; DE 3613021 C2 DE 1986-3613021

19860417

PRAI JE 1985-84235 19860418

IC ICM C30B025-02

ICS C30B025-18; H01L021-36; H01L021-40

IC C30B025-34; C30B031-08; H01L021-20

IPCR C30B0025-02 [I,A]; C30B0025-02 [I,C];
C30B0029-10 [I,C]; C30B0029-36 [I,A]; H01L0021-02
[I,C]; H01L0021-205 [I,A]

AB DE 3613021 A UPAB: 20050426

Using single crystalline Si as a substrate a thin layer of SiC is deposited by Chemical Vapour Deposition (CVD) at a temperature between pref. 900 and 1200 deg. C. This SiC coated Si substrate is then used to grow a doped layer of SiC on at a temperature pref. between 1300 and 1400 degrees C. Specifically the p-type dopant is added to the gas stream by producing a volatile chloride compound of the dopant in the same reactor-tube, with a controlled concentration, while the SiC layer is deposited. The dopant is pref. aluminium and the chloride is formed by high temperature reaction with HCl-gas.

USE/ADVANTAGE - The process allows p-type doped layers of SiC to be mfd. in production quantities and of a quality suitable for use in semiconductor devices. The material produced is easily used in the formation of light-emitting devices and photo-sensitive devices. The process allows the mfr. of semiconductor devices which can be used in applications involving high temps., high density radiation or high performance conditions unsuitable for conventional materials such as Si.

FS CPI; EPI

MC CPI: E31-P06C; L04-A01; L04-C01B; L04-C02C

EPI: U11-C01; U11-C01B

=> d 37-49 ibib abs ind

L57 ANSWER 37 OF 49 COMPENDEX COPYRIGHT 2007 EEI on STN

ACCESSION NUMBER: 1998(20):2916 COMPENDEX Full-text

TITLE: Growth and characterization of SiC power device material.

AUTHOR: Kordina, O. (Linkoping Univ, Linkoping, Sweden);

Henry, A.; Janzen, E.; Carter, C.H.Jr.

MEETING TITLE: Proceedings of the 1997 7th International Conference on Silicon Carbide, III-Nitrides and Related Materials, ICSCIII.Part 1 (of 2).

MEETING LOCATION: Stockholm, Sweden

MEETING DATE: 31 Sep 1997-05 Sep 1997

SOURCE: Materials Science Forum v 264-268 n pt 1 1998.p 97-102

SOURCE: Materials Science Forum v 264-268 n pt 1 1998.p 97-102

CODEN: MSFOEP ISSN: 0255-5476

PUBLICATION YEAR: 1998

MEETING NUMBER: 48160

DOCUMENT TYPE: Journal

TREATMENT CODE: Experimental

LANGUAGE: English

AN 1998(20):2916 COMPENDEX Full-text

AB This paper will focus on growth and characterization of epitaxial power device material. The paper is organized into three sections: The first section, which will be most emphasized, deals with the ongoing hot-wall Chemical Vapour Deposition (CVD) activity at Linkoping University running partly under the ABB power device program. The second section describes briefly the material from the hot-wall CVD program at Cree Research, Inc. The final section is devoted to the High Temperature CVD (HTCVD) growth concept running at Linkoping University. The hot-wall CVD process provides substantial advantages in terms of obtaining low doping and good morphology for the thick layers. The intrinsic background doping is generally n-type in the low 10¹⁴ cm⁻³ range. The impurity incorporation of unwanted impurities such as Al, B or Ti is very low. The doping and thickness uniformities, as well as the run-to-run

reproducibility are excellent and most importantly, the morphology is very good. The major draw-back with the CVD process in general is the low growth rate which, in general, only amounts to 3-5 $\mu\text{m/hr}$. Sometimes higher rates may be obtained, however, at the expense of a greater sensitivity to impurity incorporation. The recently proposed HTCVD growth concept suggests a viable alternative to the CVD process due to the tremendous growth rates which may amount to several hundreds of $\mu\text{m/hr}$. In fact, the HTCVD process is not only a viable alternative to the CVD process but also a potential candidate for bulk growth. (Author abstract) 11 Refs.

AN 1998(20):2916 COMPENDEX [Full-text](#)
 CC 804.2 Inorganic Components; 712.1.2 Compound Semiconducting Materials; 802.3 Chemical Operations; 933.1.2 Crystal Growth; 712.1 Semiconducting Materials; 933.1 Crystalline Solids
 CT *Silicon carbide; Epitaxial growth; Chemical vapor deposition; Semiconductor doping; Crystal impurities; High temperature operations; Morphology; Semiconducting silicon compounds
 ST Power device materials; High temperature chemical vapour deposition (HTCVD)
 ET Al; B; Ti; C*Si; SiC; Si cp; cp; C cp

L57 ANSWER 38 OF 49 COMPENDEX COPYRIGHT 2007 EEI on STN

ACCESSION NUMBER: 1998(20):2918 COMPENDEX [Full-text](#)
 TITLE: Growth of thick epitaxial 4H-SiC layers by chemical vapor deposition.
 AUTHOR: Kordina, O. (Cree Research, Inc, Durham, NC, USA); Irvine, K.; Sumakeris, J.; Kong, H.S.; Paisley, M.J.; Carter, C.H.Jr.
 MEETING TITLE: Proceedings of the 1997 7th International Conference on Silicon Carbide, III-Nitrides and Related Materials, ICSCIII.Part 1 (of 2).
 MEETING LOCATION: Stockholm, Sweden
 MEETING DATE: 31 Sep 1997-05 Sep 1997
 SOURCE: Materials Science Forum v 264-268 n pt 1 1998.p 107-110
 SOURCE: Materials Science Forum v 264-268 n pt 1 1998.p 107-110
 CODEN: MSFOEP ISSN: 0255-5476
 PUBLICATION YEAR: 1998
 MEETING NUMBER: 48160
 DOCUMENT TYPE: Journal
 TREATMENT CODE: Experimental
 LANGUAGE: English

AN 1998(20):2918 COMPENDEX [Full-text](#)

AB Thick, low doped epitaxial layers have been grown on 4H- SiC substrates by chemical vapor deposition. The layers were grown in a hot-wall type reactor to thicknesses in excess of 150 μm and with a thickness uniformity of 5% or better. The intrinsic doping of the layers is normally n-type in the low 10¹⁴ cm^{-3} as determined from mercury probe C-V profiling and photoluminescence measurements. The residual background impurities of Al, B and Ti are generally low. Higher concentrations of these may, however, be present at the substrate/epi interface. (Author abstract) 10 Refs.

AN 1998(20):2918 COMPENDEX [Full-text](#)
 CC 804.2 Inorganic Components; 712.1.2 Compound Semiconducting Materials; 802.3 Chemical Operations; 933.1.2 Crystal Growth; 712.1 Semiconducting Materials; 741.1 Light. Optics
 CT *Silicon carbide; Epitaxial growth; Chemical vapor deposition; Semiconductor doping; Substrates; Photoluminescence; Crystal impurities; Semiconducting silicon compounds

ST Residual background impurities; Hot wall type reactors

ET C*H*Si; is; H is; 4H; SiC; Si cp; cp; C cp; 4H-SiC; C*V; C-V; Al; B; Ti

L57 ANSWER 39 OF 49 COMPENDEX COPYRIGHT 2007 EEI on STN

ACCESSION NUMBER: 1998(13):5145 COMPENDEX Full-text

TITLE: Amorphous/crystalline silicon two terminal visible/infrared tunable photodetector: modeling and realization.

AUTHOR: De Cesare, G. (Dep of Electronic Engineering, Roma, Italy); Irrera, F.; Tucci, M.

MEETING TITLE: Proceedings of the 1997 MRS Spring Symposium.

MEETING ORGANIZER: MRS

MEETING LOCATION: San Francisco, CA, USA

MEETING DATE: 31 Mar 1997-04 Apr 1997

SOURCE: Amorphous and Microcrystalline Silicon Technology Materials Research Society Symposium Proceedings v 467 1997.MRS, Warrendale, PA, USA.p 937-942

SOURCE: Amorphous and Microcrystalline Silicon Technology Materials Research Society Symposium Proceedings v 467 1997.MRS, Warrendale, PA, USA.p 937-942

CODEN: MRSPDH ISSN: 0272-9172

PUBLICATION YEAR: 1997

MEETING NUMBER: 46963

DOCUMENT TYPE: Conference Article

TREATMENT CODE: Theoretical; Experimental

LANGUAGE: English

AN 1998(13):5145 COMPENDEX Full-text

AB Difference in the absorption coefficient profile of the amorphous and crystalline silicon is the key idea for the realization of a new visible/infrared tunable photodetector (VIP). The device consists on a n-doped a-Si:H/intrinsic a-Si:H/p-doped a-SiC:H multilayer grown by PECVD on a p-type crystalline silicon wafer doped by a phosphorous diffusion. A grid-shaped aluminum front contact with transparent conductive oxide coating is used as window for the incident light. Tunable sensitivity in the visible and near infrared spectral range can be achieved under different values of the external voltage, with excellent spectral separation between the two quantum efficiencies peaks at 480 nm and 800 nm. A simple analytical model taking into account the absorption profile, diffusion and drift lengths, and layer thicknesses reproduces fairly well the experimental results. (Author abstract) 12 Refs.

AN 1998(13):5145 COMPENDEX Full-text

CC 549.3 Others (including Bismuth, Boron, Cadmium, Cobalt, Mercury, Niobium, Selenium, Silicon, Tellurium and Zirconium); 933.2 Amorphous Solids; 741.3 Optical Devices and Systems; 714.2 Semiconductor Devices and Integrated Circuits; 932.3 Plasma Physics; 802.2 Chemical Reactions

CT *Amorphous silicon; Current voltage characteristics; Plasmas; Chemical vapor deposition; Phosphorus; Diffusion; Quantum efficiency; Photodetectors; Silicon wafers; Multilayers

ST Crystalline silicon; Visible infrared tunable photodetector

ET H*Si; Si:H; H doping; doped materials; C*H*Si; SiC:H; Si cp; cp; C cp

L57 ANSWER 40 OF 49 COMPENDEX COPYRIGHT 2007 EEI on STN

ACCESSION NUMBER: 1997(37):5946 COMPENDEX Full-text

TITLE: Damage annealing and dopant activation in Al ion implanted alpha-SiC

AUTHOR: Canut, B. (Universite Claude Bernard Lyon I, Villeurbanne, Fr); Ramos, S.; Roger, J.-A.;

Chante, J.-P.; Locatelli, M.-L.; Planson, D.
 MEETING TITLE: Proceedings of the 1996 E-MRS Spring Meeting.
 MEETING LOCATION: Strasbourg, Fr
 MEETING DATE: 04 Jun 1996-07 Jun 1996
 SOURCE: Materials Science & Engineering B: Solid-State
 Materials for Advanced Technology v B46 n 1-3 Apr
 1997.p 267-270
 SOURCE: Materials Science & Engineering B: Solid-State
 Materials for Advanced Technology v B46 n 1-3 Apr
 1997.p 267-270
 CODEN: MSBTEK ISSN: 0921-5107
 PUBLICATION YEAR: 1997
 MEETING NUMBER: 45892
 DOCUMENT TYPE: Journal
 TREATMENT CODE: Experimental
 LANGUAGE: English

AN 1997(37):5946 COMPENDEX Full-text

AB Aluminum ions were implanted at room temperature into n-type 6H-SiC single crystals. In order to obtain a quasi rectangular atom distribution over approximately 0.5 μm , two successive implantations were performed up to a maximum energy of 320 keV and a total fluence of 1.6 multiplied by 10¹⁵ ions cm^{-2} . The samples were then annealed under nitrogen in a rf furnace, allowing a temperature range from 1000 to 1800 degree C. The recovery of the lattice disorder was followed by using Rutherford backscattering spectrometry of 2 MeV He plus ions in channeling geometry (RBS/C), in conjunction with optical absorption measurements. The electrical behavior of the implanted material was tested by sheet resistance measurements. The unimplanted side of the target has been characterized by both RBS/C and X-ray photoelectron spectroscopy (XPS). A significant decrease of the surface stoichiometry left bracket Si/C right bracket has been evidenced for the highest annealing temperatures. (Author abstract) 14 Refs.

AN 1997(37):5946 COMPENDEX Full-text

CC 804.2 Inorganic Components; 541.1 Aluminum; 712.1 Semiconducting Materials; 932.1 High Energy Physics; 801 Chemistry; 942.2 Electric Variables Measurements

CT *Silicon carbide; Single crystals;
 Annealing; Semiconductor doping; Rutherford
 backscattering spectroscopy; Electric resistance measurement; X ray
 photoelectron spectroscopy; Surface structure; Aluminum; Ion
 implantation

ST Rutherford backscattering spectrometry/channeling geometry (RBS/C)

ET C*H*Si; is; H is; 6H; SiC; Si cp; cp; C cp; 6H-SiC; Si; Al; C*Si

L57 ANSWER 41 OF 49 COMPENDEX COPYRIGHT 2007 EEI on STN

ACCESSION NUMBER: 1996(49):720 COMPENDEX Full-text

TITLE: Design and performance of a new reactor for vapor
 phase epitaxy of 3C, 6H, and 4H SiC.

AUTHOR: Nordell, N. (Industrial Microelectronics Cent,
 Kista, Sweden); Schoner, A.; Andersson, S.G.

SOURCE: Journal of the Electrochemical Society v 143 n 9
 Sep 1996.p 2910-2919

SOURCE: Journal of the Electrochemical Society v 143 n 9
 Sep 1996.p 2910-2919

CODEN: JESQAN ISSN: 0013-4651

PUBLICATION YEAR: 1996

DOCUMENT TYPE: Journal

TREATMENT CODE: Experimental

LANGUAGE: English

AN 1996(49):720 COMPENDEX Full-text

- AB The design of a new horizontal reactor for vapor phase epitaxy of SiC is presented. The reactor has a graphite inner cell with rectangular cross section to align the gas stream, and it may handle temperatures up to 1700 degree C. The inner cell is surrounded by a highly reflecting heat shield. 6H and 4H SiC were grown homoepitaxially, and 3C SiC was grown on (111) and (001) oriented Si. The 3C SiC is shown to be epitaxially oriented to the substrate, but with some mosaicity. For 4H and 6H SiC the crystallinity is limited by the substrates, and for layers thicker than 20 μ m step bunching appears. Unintentionally doped material is n-type and has a doping concentration in the 10¹⁵ cm⁻³ range. Intentional N and Al doping could be controlled from 10¹⁶ cm⁻³ up to 10¹⁹ and 10²¹ cm⁻³, respectively. The compensation level is in all cases in the range of 10¹⁴ cm⁻³. The Al doping turn-off from a concentration of 2 multiplied by 10¹⁹ cm⁻³ to 2 multiplied by 10¹⁵ cm⁻³ over 50 nm has been achieved by using an HCl etch at the interface. The thickness uniformity is within plus or minus 24% for growth at 1250 degree C, but improved to within plus or minus 6% for growth at 1550 degree C. From growth behavior at different growth conditions we conclude that the process is mainly diffusion limited. (Author abstract) 26 Refs.
- AN 1996(49):720 COMPENDEX Full-text
- CC 704.1 Electric Components; 804.2 Inorganic Components; 933.1.2 Crystal Growth; 631.1.2 Gas Dynamics; 801.4 Physical Chemistry; 541.1 Aluminum
- CT *Electric reactors; Vapor phase epitaxy; Gas dynamics; Doping (additives); Aluminum; Etching; Hydrochloric acid; Interfaces (materials); Silicon carbide
- ST Crystallinity; Graphite inner cell; Gas stream; Horizontal reactor; Thickness uniformity
- ET C*Si; SiC; Si cp; cp; C cp; C; H; 6H; is; H is; 4H; Si; N; Al; Cl*H; HCl; H cp; Cl cp

L57 ANSWER 42 OF 49 COMPENDEX COPYRIGHT 2007 EEI on STN

ACCESSION NUMBER: 1997(1):2219 COMPENDEX Full-text

TITLE: Growth and electronic properties of epitaxial TiN thin films on 3C-SiC(001) and 6H-SiC(0001) substrates by reactive magnetron sputtering.

AUTHOR: Hultman, L. (Linköping Univ, Linköping, Sweden); Ljungcrantz, H.; Hallin, C.; Janzen, E.; Sundgren, J.-E.; Pecs, B.; Wallenberg, L.R.

SOURCE: Journal of Materials Research v 11 n 10 Oct 1996.p 2458-2462

SOURCE: Journal of Materials Research v 11 n 10 Oct 1996.p 2458-2462

CODEN: JMREEE ISSN: 0884-2914

PUBLICATION YEAR: 1996

DOCUMENT TYPE: Journal

TREATMENT CODE: Experimental

LANGUAGE: English

AN 1997(1):2219 COMPENDEX Full-text

AB Epitaxial TiN films were grown on cubic (3C)-SiC(001) and hexagonal (6H)-SiC(0001) substrates by ultrahigh vacuum reactive magnetron sputtering from a Ti target in a mixed Ar and N₂ discharge at a substrate temperature of 700 degree C. Cross-sectional transmission electron microscopy, including high-resolution imaging, showed orientational relationships TiN(001) parallel 3C-SiC(001), and TiN left bracket 110 right bracket parallel 3C-SiC left bracket 110 right bracket, and TiN(111) parallel 6H-SiC(0001) and TiN left bracket 110 right bracket, left bracket 101 right bracket parallel 6H-SiC left bracket 12 over bar 10 right bracket. In the latter case, twin-related TiN domains formed as the result of nucleation on SiC terraces with an inequivalent stacking sequence of Si and C. The TiN/SiC interface was locally

atomically sharp for both SiC polytypes. Defects in the TiN layers consisted of threading double positioning domain boundaries in TiN(111) on 6H-SiC. Stacking faults in 3C-SiC did not propagate upon growth of TiN. Room-temperature resistivity of TiN films was ρ equals 14 $\mu\Omega$ cm for 6H-SiC(0001) and ρ equals 17 $\mu\Omega$ cm for 3C-SiC(001) substrates. Specific contact resistance of TiN to 6H-SiC(0001) was 1.3 multiplied by 10 minus 3 Ω cm² for a 6H-SiC substrate with an n-type doping of 5 multiplied by 10¹⁷ cm⁻³. (Author abstract) 24 Refs.

AN 1997(1):2219 COMPENDEX [Full-text](#)
 CC 804.2 Inorganic Components; 933.1.2 Crystal Growth; 701.1 Electricity: Basic Concepts and Phenomena; 933.1.1 Crystal Lattice; 931.2 Physical Properties of Gases, Liquids and Solids
 CT *Titanium nitride; Crystal orientation; Epitaxial growth; Silicon carbide; Substrates; Magnetron sputtering; Electronic properties; Electric conductivity of solids; Thin films; Film growth
 ST Ultrahigh vacuum reactive magnetron sputtering
 ET N-Ti; TiN; Ti cp; cp; N cp; C; C*Si; SiC; Si cp; C cp; H; 6H; is; H is; Ti; Ar; N2; C-SiC; C*H*Si; 6H-SiC; Si

L57 ANSWER 43 OF 49 COMPENDEX COPYRIGHT 2007 EEI on STN

ACCESSION NUMBER: 1996(26):2406 COMPENDEX [Full-text](#)

TITLE: Low resistivity aluminum nitride: carbon (AlN:C) films grown by metal organic chemical vapor deposition.

AUTHOR: Wongchotigul, K. (Howard Univ, Washington, DC, USA); Chen, N.; Zhang, D.P.; Tang, X.; Spencer, M.G.

SOURCE: Materials Letters v 26 n 4-5 Mar 1996.p 223-226

SOURCE: Materials Letters v 26 n 4-5 Mar 1996.p 223-226

CODEN: MLETDJ ISSN: 0167-577X

PUBLICATION YEAR: 1996

DOCUMENT TYPE: Journal

TREATMENT CODE: Experimental

LANGUAGE: English

AN 1996(26):2406 COMPENDEX [Full-text](#)

AB Low resistivity, p-type, single crystal aluminum nitride-carbon (AlN:C) films were grown by metal organic chemical vapor deposition (MOCVD). Films produced with high partial pressure of propane during growth exhibited high conductivity. Van der Pauw measurements indicated that the resistivity of the as-grown films changed dramatically from 108 Ω cm for unintentionally doped samples to less than 0.1 Ω cm for partial pressures of propane greater than 0.5 multiplied by 10 minus 3 Torr. Reflection high energy electron diffraction (RHEED) measurements performed 'in situ' just after film growth indicated that the material is single crystal up to a propane partial pressure of 2.5 multiplied by 10 minus 3 Torr. P-n junctions of n-type 6H-SiC and p-type AlN:C were fabricated, and blue emission (centered at 490 nm) was observed from the heterojunction under forward bias. (Author abstract) 4 Refs.

AN 1996(26):2406 COMPENDEX [Full-text](#)

CC 933.1.2 Crystal Growth; 712.1.2 Compound Semiconducting Materials; 701.1 Electricity: Basic Concepts and Phenomena; 942.2 Electric Variables Measurements; 931.3 Atomic and Molecular Physics; 933.1 Crystalline Solids

CT *Film growth; Propane; Metallorganic chemical vapor deposition; Electric conductivity of solids; Electric conductivity measurement; Reflection high energy electron diffraction; Single crystals; Heterojunctions; Semiconducting aluminum compounds; Semiconducting films

ST Aluminum nitride carbon; Partial pressure; Van der Pauw measurements; Blue emission; PN junctions

ET C*Al*N; AlN:C; C doping; doped materials; Al cp; cp; N cp; P; C*H*Si; is; H is; 6H; SiC; Si cp; C cp; 6H-SiC

L57 ANSWER 44 OF 49 COMPENDEX COPYRIGHT 2007 EEI on STN

ACCESSION NUMBER: 1996(48):3369 COMPENDEX Full-text

TITLE: Growth and properties of III-V nitride films, quantum well structures and integrated heterostructure devices.

AUTHOR: Schetzina, J.F. (North Carolina State Univ, Raleigh, NC, USA)

MEETING TITLE: Proceedings of the 1995 MRS Fall Meeting.

MEETING ORGANIZER: MRS

MEETING LOCATION: Boston, MA, USA

MEETING DATE: 27 Nov 1995-01 Dec 1995

SOURCE: 1st International Symposium on Gallium Nitride and Related Materials Materials Research Society Symposium Proceedings v 395 1996. Materials Research Society, Pittsburgh, PA, USA.p 123-134

SOURCE: 1st International Symposium on Gallium Nitride and Related Materials Materials Research Society Symposium Proceedings v 395 1996. Materials Research Society, Pittsburgh, PA, USA.p 123-134

CODEN: MRSPDH ISSN: 0272-9172

PUBLICATION YEAR: 1996

MEETING NUMBER: 44427

DOCUMENT TYPE: Conference Article

TREATMENT CODE: Experimental

LANGUAGE: English

AN 1996(48):3369 COMPENDEX Full-text

AB Growth of III-V nitrides by molecular beam epitaxy (MBE) is being studied at NCSU using an rf nitrogen plasma source. GaN/ SiC substrates consisting of approx. 3 μ m thick GaN buffer layers grown on 6H-SiC wafers by MOVPE at Cree Research, Inc. are being used as substrates in the MBE film growth experiments. The MBE-grown GaN films exhibit excellent structural and optical properties - comparable to the best GaN films grown by MOVPE - as determined from photoluminescence, x-ray diffraction, and vertical-cross-section TEM micrographs. Mg and Si have been used as dopants for p-type and n-type layers, respectively. AlxGa1-x nitride films (x approx. 0.06-0.08) and AlxGa1-x nitride laser diodes can be demonstrated and commercialized are discussed. New integrated heterostructures are proposed for the development of a variety of vertical-transport devices such as light-emitting diodes, laser diodes, photocathodes, electron emitters based on the negative-electron-affinity of AlN, and certain transistor structures. (Author abstract) 13 Refs.

AN 1996(48):3369 COMPENDEX Full-text

CC 712.1.2 Compound Semiconducting Materials; 804.2 Inorganic Components; 933.1.2 Crystal Growth; 932.3 Plasma Physics; 741.1 Light. Optics; 714.2 Semiconductor Devices and Integrated Circuits

CT *Semiconducting films; Crystal structure; Molecular beam epitaxy; Plasma sources; Optical properties; Semiconductor quantum wells; Heterojunctions; Photoluminescence; Nitrides; Film growth

ST Vertical transport devices; Negative electron affinity; Integrated heterostructure devices; Dopants; Buffer layers

ET V; Ga*N; GaN; Ga cp; cp; N cp; C*Si; SiC; Si cp; C cp; C*H*Si; is; H is; 6H; 6H-SiC; Mg; Si; Al*Ga; Al sy 2; sy 2; Ga sy 2; AlxGa1-x; Al cp; Al*N; AlN

L57 ANSWER 45 OF 49 COMPENDEX COPYRIGHT 2007 EEI on STN
 ACCESSION NUMBER: 1992(10):130267 COMPENDEX Full-text
 DOCUMENT NUMBER: 9210131679
 TITLE: alpha -SiC buried-gate junction field effect transistors.
 AUTHOR: Kelner, G. (Naval Research Lab, Washington, DC, USA); Binari, S.; Shur, M.; Sieger, K.; Palmour, J.; Kong, H.
 MEETING TITLE: European Materials Research Society 1990 Fall Meeting, Symposium C: Properties and Applications of SiC, Natural and Synthetic Diamond and Related Materials.
 MEETING LOCATION: Strasbourg, Fr
 MEETING DATE: 27 Nov 1990-30 Nov 1990
 SOURCE: Materials Science & Engineering B: Solid-State Materials for Advanced Technology v B11 n 1-4 Jan 15 1992.p 121-124
 SOURCE: Materials Science & Engineering B: Solid-State Materials for Advanced Technology v B11 n 1-4 Jan 15 1992.p 121-124
 CODEN: MSBTEK ISSN: 0921-5107
 PUBLICATION YEAR: 1992
 MEETING NUMBER: 16250
 DOCUMENT TYPE: Journal
 TREATMENT CODE: Experimental
 LANGUAGE: English

AN 1992(10):130267 COMPENDEX DN 9210131679 Full-text
 AB We report the results of an experimental study on alpha -SiC buried-gate junction field effect transistors operating in the temperature range from 24 to 400 degree C. The epitaxial structure used for fabrication of these devices employs a nitrogen- doped hexagonal alpha -SiC layer grown on a p-type aluminum-doped alpha - SiC film. Epitaxial layers were grown on the silicon face of unintentionally doped n-type alpha - SiC substrates. The current in the channel is modulated using the p-type layer as a gate. Fabricated devices with a 4 mu m gate length have a maximum transconductance (gm) of 17 mS mm minus 1 and a drain saturation current (Ioss) of 450 mA mm minus 1 at room temperature. This value of the transconductance is the highest reported for devices of similar structure. Devices are completely pinched off at a gate voltage of minus 40V. The device transconductance drops with increasing temperature owing to the decrease in electron mobility. The values of electron mobility at elevated temperatures derived from the measured transconductances and drain conductances are in agreement with independently measured Hall data. (Author abstract) 7 Refs.

AN 1992(10):130267 COMPENDEX DN 9210131679 Full-text
 CC 804 Chemical Products; 812 Ceramics & Refractories; 701 Electricity & Magnetism; 931 Applied Physics; 714 Electronic Components
 CT *SILICON CARBIDE:Electronic Properties;
 SEMICONDUCTOR DEVICES:Junctions; TRANSISTORS, FIELD
 EFFECT:Gates; SEMICONDUCTING SILICON:Coatings;
 CRYSTALS:Epitaxial Growth; SILICON CARBIDE
 :Amorphous
 ST BURIED GATE JUNCTIONS; TRANSCONDUCTANCE; DRAIN CONDUCTANCE
 ET C*Si; SiC; Si cp; cp; C cp

L57 ANSWER 46 OF 49 JAPIO (C) 2007 JPO on STN
 ACCESSION NUMBER: 1999-329974 JAPIO Full-text
 TITLE: METHOD FOR GROWING SILICON
 CARBIDE EPITAXIALLY
 INVENTOR: ASAI RYUICHI; UENO KATSUNORI

PATENT ASSIGNEE(S): FUJI ELECTRIC CO LTD
 PATENT INFORMATION:

PATENT NO	KIND	DATE	ERA	MAIN IPC
JP 11329974	A	19991130	Heisei	H01L021-205

APPLICATION INFORMATION

STN FORMAT: JP 1998-128469 19980512
 ORIGINAL: JP10128469 Heisei
 PRIORITY APPLN. INFO.: JP 1998-128469 19980512
 SOURCE: PATENT ABSTRACTS OF JAPAN (CD-ROM), Unexamined Applications, Vol. 1999

AN 1999-329974 JAPIO Full-text

AB PROBLEM TO BE SOLVED: To protect a growth process against contamination even after repeated use by employing a silicon carbide susceptor.
 SOLUTION: A silicon carbide susceptor of 50 mm×20 mm×10 mm, for example, is prepared from polycrystalline β -type silicon carbide synthesized by CVD using monosilane and propane. Resistivity is set at 10 $\mu\Omega$ at the time of CVD by doping it with phosphorus or nitrogen. A thin silicon carbide film is grown epitaxially on a single crystal silicon carbide wafer using such a susceptor repeatedly. When a thin silicon carbide film is grown on a single crystal silicon carbide wafer, n-type conductivity can be attained without requiring any intended impurity doping. When a silicon carbide susceptor is employed, contamination of epitaxial process is avoided and durability of susceptor can be enhanced resulting in cost reduction.
 COPYRIGHT: (C)1999,JPO

IC ICM H01L021-205

L57 ANSWER 47 OF 49 JAPIO (C) 2007 JPO on STN
 ACCESSION NUMBER: 1992-096373 JAPIO Full-text
 TITLE: SEMICONDUCTOR DEVICE
 INVENTOR: SATO FUMIHIKO
 PATENT ASSIGNEE(S): NEC CORP
 PATENT INFORMATION:

PATENT NO	KIND	DATE	ERA	MAIN IPC
JP 04096373	A	19920327	Heisei	H01L029-165

APPLICATION INFORMATION

STN FORMAT: JP 1990-213848 19900813
 ORIGINAL: JP02213848 Heisei
 PRIORITY APPLN. INFO.: JP 1990-213848 19900813
 SOURCE: PATENT ABSTRACTS OF JAPAN (CD-ROM), Unexamined Applications, Vol. 1992

AN 1992-096373 JAPIO Full-text

AB PURPOSE: To inhibit the increase of the resistance component of an emitter even in a transistor in fine emitter size by composing a base of a first insular region and constituting the emitter of second and third insular regions.
 CONSTITUTION: A high-concentration N-type buried layer 2 and a high - concentration P-type channel stopper 3 by ion implantation are formed on a P-type silicon substrate 1. An N-type silicon epitaxial growth layer 5, from which an auto-doping section from the buried layer 2 is removed and which has thickness of approximately 1 μm and concentration of 5 $\times 10^{15}$ /cm³ is formed, is shaped, and a P-type base layer 6, which is surrounded by field oxide films 4 by LOCOS selective oxidation and has thickness of approximately 1000 \AA ; and the peak of approximately 3 $\times 10^{18}$ /cm³ of boron concentration, is formed. An N-

type silicon carbide layer 8, which is surrounded by a PSG film 7 and has 100Å; thickness and concentration of 3×10¹⁸/cm³ and forbidden band width of 2.2eV, is formed. A high-concentration N-type polysilicon emitter layer 9 having concentration of 2×10²⁰/cm³ and 2000Å; thickness is formed onto the layer 8, and an Al group electrode 10 is formed onto the single crystal 5 not coated with the PSG film 7 and polysilicon 9. COPYRIGHT: (C)1992,JPO&Japio

IC ICM H01L029-165
ICS H01L021-331; H01L029-73

L57 ANSWER 48 OF 49 JAPIO (C) 2007 JPO on STN
ACCESSION NUMBER: 1986-085822 JAPIO Full-text
TITLE: LIQUID EPITAXIAL GROWTH PROCESS OF SiC SINGLE CRYSTAL
INVENTOR: MATSUSHITA YASUHIKO
PATENT ASSIGNEE(S): SANYO ELECTRIC CO LTD
PATENT INFORMATION:

PATENT NO	KIND	DATE	ERA	MAIN IPC
JP 61085822	A	19860501	Showa	H01L021-208

APPLICATION INFORMATION

STN FORMAT: JP 1984-208702 19841004
ORIGINAL: JP59208702 Showa
PRIORITY APPLN. INFO.: JP 1984-208702 19841094
SOURCE: PATENT ABSTRACTS OF JAPAN (CD-ROM), Unexamined Applications, Vol. 1986

AN 1986-085822 JAPIO Full-text

AB PURPOSE: To grow red and blue color light emitting element by means of changing the temperature of Si melt containing Al and N as impurity or light emitting element. CONSTITUTION: A crucible 11 made of high purity graphite is filled with Si melt 13 to immerse a 6HSiC single crystal substrate 1 in the melt 13. Firstly an n type layer 2 is grown on the substrate 1 by means of immersing the substrate 1 in the Si melt 13 respectively doped with 3.5×10¹⁸/cm³ and 0.074wt% of n and 0.074wt% of Al to be held at 1,450°C; 1,520°C. Secondly a p type layer 3 is grown by means of immersing the substrate 1 with the n type layer 2 grown thereon in the Si melt 13 containing 2.54wt% of Al to be held at 1,450°C; 1,520°C. Through these procedures, an SiC red color light emitting element is produced. Besides, blue color with light emitting peak at around 460nm may be emitted by means of raising the temperature of Si melt up to 1,600°C.
COPYRIGHT: (C)1986,JPO&Japio

IC ICM H01L021-208
ICS H01L033-00

L57 ANSWER 49 OF 49 JAPIO (C) 2007 JPO on STN
ACCESSION NUMBER: 1985-260498 JAPIO Full-text
TITLE: GROWTH METHOD OF SiC SINGLE CRYSTAL
INVENTOR: MATSUSHITA YASUHIKO
PATENT ASSIGNEE(S): SANYO ELECTRIC CO LTD
PATENT INFORMATION:

PATENT NO	KIND	DATE	ERA	MAIN IPC
JP 60260498	A	19851223	Showa	C30B029-36

APPLICATION INFORMATION

STN FORMAT: JP 1984-115214 19840604

ORIGINAL: JP59115214 Showa
 PRIORITY APPLN. INFO.: JP 1984-115214 19840604
 SOURCE: PATENT ABSTRACTS OF JAPAN (CD-ROM), Unexamined
 Applications, Vol. 1985

AN 1985-260498 JAPIO Full-text

AB PURPOSE: To obtain single crystal having good crystallizing property and a small impurity content by shifting an SiC single crystal substrate in an Si melt containing specified elements, separated to high temperature zone and low temperature zone and can be heated to elevate its temperature in a stage for forming an SiC single crystal having p-n junction.

CONSTITUTION: An Si melt containing Al as p type dopant is charged to a carbon crucible 1 having opened upper surface, and a high temperature zone A being elevated to ca. 1,650°C at its center and a low temperature zone B being at lower temperature than A are provided. About 0.3°C/mm temperature gradient is provided to the low temperature zone B so that the temperature of the melt at the bottom face of the crucible 1 becomes ca. 1,630°C. In this state, an SiC single crystal substrate 4 is attached to a jig and immersed in the melt 2 so as to hold the substrate in the low temperature zone B and a p type SiC single crystal is grown on the surface of the substrate 4. Then, the substrate 4 is transferred to the high temperature zone A and the high temperature zone A is heated simultaneously so as the bottom of the high temperature zone A reaches ca. 1,700°C and the bottom of the crucible reaches ca. 1,670°C. Thus, A in the melt 2 is removed by evaporation and the melt 2 is brought to a non-doped condition. Thereafter, N<SB>2</SB> is introduced into the melt 2 and the substrate 4 is transferred to the low temperature zone B, and an n type SiC single crystal is grown on a p type SiC single crystal.

COPYRIGHT: (C)1985,JPO&Japio

IC ICM C30B029-36
 ICS C30B019-00

=> d his nofile

(FILE 'HOME' ENTERED AT 14:49:53 ON 01 NOV 2007)

FILE 'HCAPLUS' ENTERED AT 14:50:03 ON 01 NOV 2007

L1 1 SEA ABB=ON PLU=ON US20060137600/PN
SEL RN

FILE 'REGISTRY' ENTERED AT 14:50:18 ON 01 NOV 2007

L2 7 SEA ABB=ON PLU=ON (409-21-2/BI OR 74-82-8/BI OR 74-85-1/B
I OR 74-98-6/BI OR 7429-90-5/BI OR 7727-37-9/BI OR
7803-62-5/BI)
L3 1 SEA ABB=ON PLU=ON 7429-90-5/RN
L4 1 SEA ABB=ON PLU=ON 7727-37-9/RN
L5 1 SEA ABB=ON PLU=ON 409-21-2/RN

FILE 'HCAPLUS' ENTERED AT 14:52:35 ON 01 NOV 2007

L6 1535625 SEA ABB=ON PLU=ON L3 OR AL OR ALUMINUM OR ALUMINIUM
L7 419214 SEA ABB=ON PLU=ON L4 OR N2 OR NIROGEN
L8 138178 SEA ABB=ON PLU=ON L5 OR CSI OR SIC OR SILICON CARBIDE#
L9 1 SEA ABB=ON PLU=ON L8 AND L1
L10 38625 SEA ABB=ON PLU=ON L8 AND (L6 OR L7)
L11 908 SEA ABB=ON PLU=ON L10 AND WAFER#
E SEMICONDUCTORES/CT
L12 112669 SEA ABB=ON PLU=ON SEMICONDUCTORS+PFT,NT/CT
L13 1113 SEA ABB=ON PLU=ON L10 AND L12
L14 8507 SEA ABB=ON PLU=ON L10 AND (SUBSTRAT? OR WAFER? OR DISK#
OR DISC#)
L15 8958 SEA ABB=ON PLU=ON L13 OR L14
L16 3185 SEA ABB=ON PLU=ON L15 AND DEV/RL
L17 655 SEA ABB=ON PLU=ON L16 AND DOP?
L18 164 SEA ABB=ON PLU=ON L17 AND (N-TYPE OR N(A)TYPE NTYPE OR
PTYPE OR P-TYPE OR P(A)TYPE OR (N OR P)(2A)TYPE)
L19 40 SEA ABB=ON PLU=ON L18 AND CRYSTAL?
L20 1 SEA ABB=ON PLU=ON L19 AND L1
L21 QUE ABB=ON PLU=ON MU OR MICRON OR MICROMETER OR
MICRO(W)METER OR NANOMETER OR NANO(W)METER OR NM OR MM
L22 14 SEA ABB=ON PLU=ON L19 AND L21
L23 0 SEA ABB=ON PLU=ON L22 AND L1
L24 40 SEA ABB=ON PLU=ON L19 OR (L22 OR L23)
L25 0 SEA ABB=ON PLU=ON L24 AND INDEX(2A)DIRECT?
L26 2 SEA ABB=ON PLU=ON L24 AND (PARALLEL OR MILLER)
L27 25 SEA ABB=ON PLU=ON (L24 OR L25 OR L26) AND (1840-2003)/PRY
,AY,PY
L28 21 SEA ABB=ON PLU=ON L27 AND ELECTRIC?/SC,SX
L29 1 SEA ABB=ON PLU=ON L28 AND L1

FILE 'WPIX' ENTERED AT 15:19:40 ON 01 NOV 2007

L30 67329 SEA ABB=ON PLU=ON SILICON CARBIDE# OR SIC
L31 17751 SEA ABB=ON PLU=ON L30 AND (SUBSTRAT? OR WAFER? OR DISK#
OR DISC# OR SEMICONDUCT? OR SEMI(A)CONDUCT?)
L32 6081 SEA ABB=ON PLU=ON L31 AND (AL OR ALUMINUM OR ALUMINIUM
OR N2 OR NITROGEN)
L33 QUE ABB=ON PLU=ON (N-TYPE OR N(A)TYPE NTYPE OR PTYPE OR
P-TYPE OR P(A)TYPE OR (N OR P)(2A)TYPE)
L34 483 SEA ABB=ON PLU=ON L32 AND L33
L35 123 SEA ABB=ON PLU=ON L34 AND L21
L36 6 SEA ABB=ON PLU=ON L35 AND (PARALLEL OR MILLER)

```

L37      48 SEA ABB=ON   PLU=ON   L35 AND CRYSTAL?
L38      31 SEA ABB=ON   PLU=ON   L37 AND DOP?
L39      34 SEA ABB=ON   PLU=ON   L36 OR L38
L40      28 SEA ABB=ON   PLU=ON   L39 AND (PY<2004 OR PRY<2004 OR
      AY<2004)
L41      23 SEA ABB=ON   PLU=ON   L40 AND DEVICE#
L42      1 SEA ABB=ON   PLU=ON   US20060137600/PN
L43      4 SEA ABB=ON   PLU=ON   L40 AND CARRIER CONCENTRATION?
L44      1 SEA ABB=ON   PLU=ON   L40 AND CARRIER LIFETIME?
L45      1 SEA ABB=ON   PLU=ON   L40 AND C30B00157/IPC
L46      13 SEA ABB=ON   PLU=ON   L40 AND C30B7/IPC
L47      16 SEA ABB=ON   PLU=ON   (L42 OR L43 OR L44 OR L45 OR L46)

      FILE 'COMPEDEX' ENTERED AT 15:55:42 ON 01 NOV 2007
L48      82 SEA ABB=ON   PLU=ON   L34 AND L21
L49      24 SEA ABB=ON   PLU=ON   L48 AND CRYSTAL?
L50      1 SEA ABB=ON   PLU=ON   L49 AND CARRIER(A) (CONCENTRATION? OR
      LIFETIME?)
L51      1 SEA ABB=ON   PLU=ON   L49 AND (PARALLEL OR MILLER)
L52      24 SEA ABB=ON   PLU=ON   (L49 OR L50 OR L51)
L53      14 SEA ABB=ON   PLU=ON   L52 AND (PY<2004 OR PRY<2004 OR
      AY<2004)

      FILE 'JAPIO' ENTERED AT 16:00:47 ON 01 NOV 2007
L54      15 SEA ABB=ON   PLU=ON   L52 AND (PY<2004 OR PRY<2004 OR
      AY<2004)
L55      4 SEA ABB=ON   PLU=ON   L54 AND DOP?

      FILE 'COMPEDEX' ENTERED AT 16:02:54 ON 01 NOV 2007
L56      9 SEA ABB=ON   PLU=ON   L53 AND DOP?

      FILE 'HCAPLUS, WPIX, COMPEDEX, JAPIO' ENTERED AT 16:04:18 ON 01 NOV
      2007
L57      49 DUP REM L28 L47 L56 L55 (1 DUPLICATE REMOVED)
      ANSWERS '1-21' FROM FILE HCAPLUS
      ANSWERS '22-36' FROM FILE WPIX
      ANSWERS '37-45' FROM FILE COMPEDEX
      ANSWERS '46-49' FROM FILE JAPIO

```